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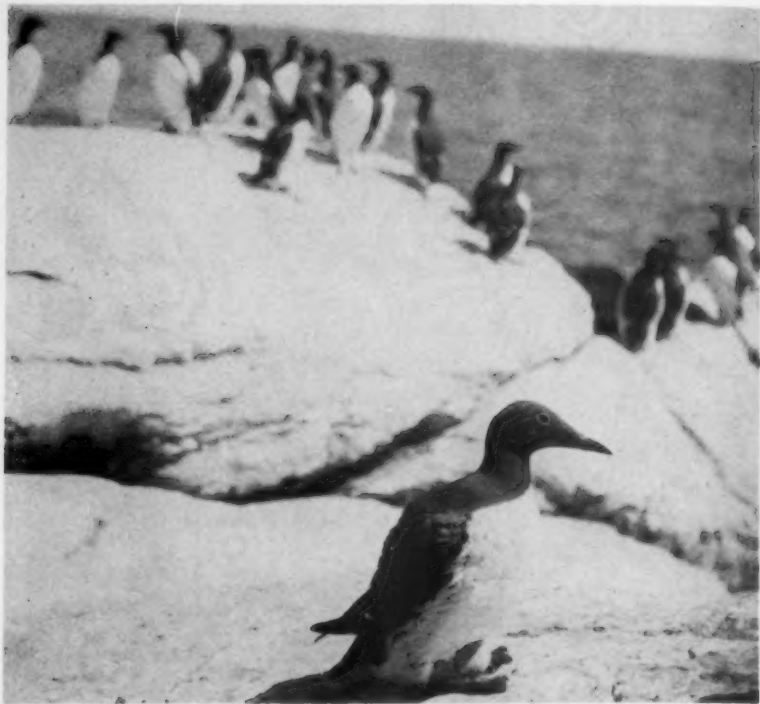
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ONE BIRD INCUBATES ON BREEDING AREA; OTHERS ARE ON LOITERING AREA



TWO PAIRS OF COURTING BIRDS ON NEST SITE

THE AUK

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NESTING BEHAVIOR OF THE ATLANTIC MURRE

BY R. A. JOHNSON

Plates 5, 6

INTRODUCTION

THE vast northern seas are the natural home of the Murre; rocky islands or inaccessible cliffs are the nesting locations. Neither are elements of a dynamic environment in a comparative sense. Except for relatively recent influence of man, I believe there are few factors to cause abrupt changes in population numbers. The rate of reproduction is slow, probably not more than 1/200, as compared to Bobwhite. It therefore seems reasonable to expect that the ontogeny of the behavior pattern has developed slowly and still shows primitive relationships.

The facts that the eggs of this species exhibit great variety, that the species is said to use no nesting material and that it is often alleged to have less intelligence than most avian species, certainly less adaptability than many, are reasons why an extensive study of its behavior pattern is greatly to be desired.

The data herein presented were gathered in connection with a general study of the natural history of the species. Thus, they are limited in scope and generally associated with observations made at the nest site. All notes refer to the species *Uria aalge aalge* made between June 20 and August 10 during the summers of 1931, 1934 and 1938, in the Cape Whittle region of the Gulf of St. Lawrence.

The purpose of this paper is, first, to present the record of some data as they were obtained so that they may be evaluated in light of future findings; and, second, to venture some generalizations about the meanings which I have deduced. In another paper (Wilson Bull., 50: 164, 1938) I have listed seven general characteristics of the Murre which are significant for this study. In the same paper I have de-

scribed the type of blinds used and other precautions taken to avoid disturbance and confusion between natural and conditioned behavior.

Early in this study I marked several birds with colored bands and stained areas of feathers with oil stains. This method was thought necessary to facilitate accurate identification. In every case I found the resulting disturbance of the colony was so great that I could not work with those birds again satisfactorily. Accordingly, it was necessary to confine observations largely to a few individuals in a colony; these birds could be identified by a combination of size, color, plumage condition and 'white-eyed' character. Young birds were tagged by placing a band on the tarsus, one made of soft copper wire on which were strung combinations of large colored beads.

CHARACTER OF NESTING ISLANDS

The nesting islands in the Cape Whittle region are mostly low flat granitic islands. On many of these there are wide shallow faults extending well down the slopes. Some of these are narrow at the top forming cave-like passages and some are deepened into crevasses with or without a partial fill of loose boulders. In such situations the Murres find desirable nesting places; but there are also many colonies of considerable size on the surface of the islands. Sometimes these colonies are made up of nesting birds scattered in small groups among nesting cormorants, or the groups may be found on a site where there is very little protection of any kind.

STRUCTURE OF A MURRE COLONY

A large breeding colony is made up of an indefinite confederation of groups of birds. These groups tend to show concentric formation in their laying and hatching dates. At the beginning of the hatching one can see the eggs which occupy the center position of the group beginning to hatch first, indicating that the first bird to lay established its nest site in a choice spot after which the next ones in sequence crowded about (see Plate 6). The presence of the early birds with their eggs makes the immediate surroundings much more desirable for nest sites. Where long rows of birds are found nesting in a crevasse I have seen the same distribution of hatching dates. This crowding together to form compact groups of nesting birds is attended by a great amount of activity,—fighting, social preening, crowding, and vocalizing,—a condition which seems to enhance the general state of satisfaction and welfare. In spite of intense and repeated fighting the birds show no evidence of being attracted to surrounding unlimited space. If the result of this instinct to crowd together has

survival value it certainly also results in the elimination of many eggs when the group is disturbed due to the eggs rolling down inclines and into water-holes as the birds stampede.

Once a bird settles with its egg on a nest site and starts incubation its presence becomes an important factor to its neighbor. If the outer individuals of an incubating group abandon or lose their eggs in connection with a disturbing factor, the remaining birds may progressively abandon (Johnson, 1938a).

DAILY LIFE OF INDIVIDUALS

The social relationships of a colony of breeding Murres are, I believe, very imperfectly understood. In furtherance of this phase of study it seems wise to describe the geography of the breeding bird's daily activity. By remaining in a small tent near a breeding colony for two or three days in sequence, observations have been made which lead me to make the following description of three functional areas in which the daily activities of the breeding birds transpire. These are as follows: first, the breeding-colony area where groups of breeding birds participate in activities associated with the nest site; second, the loitering ground, an area including the perching rocks where birds alight to enter the breeding-colony area and a limited space of the water area adjacent to land forming the nearest approach to the nest sites; third, the distant areas of the sea which form the feeding grounds where birds seem to scatter indiscriminately.¹ Around a large breeding colony birds are continually going out from and returning to the loitering ground. Often they return from the feeding ground directly to the nest site. Yet, I have often seen birds off duty from the nest site linger in the loitering ground for two or three hours. Among the colonies observed there have usually been a certain percentage of the population, which, having lost one or more eggs, were at the time of the study approaching another time for ovulation. These birds spend a great part of the day in rest and in ceremony, at first on the loitering ground, but as time for ovulation approaches they spend more time in courting ceremony at the proposed new nest site.

The average breeding Murre in the colony is a social bird. It requires only enough space on which to brood the egg. It desires to be very near to its neighbors, even to be crowded against them or to be up against a ledge or partly concealed in some cranny. It is probably stimulated by group activities. It responds quickly to warning from

¹ Paper read at the Wilson Ornithological Club meeting at Ann Arbor, December 1938.

one or all. It responds to group flight and contentment. It conducts social preening with its neighbors regardless of sex. It conducts frequent fights with its neighbors regardless of sex and these seem to intensify the incubation instinct rather than to vanquish the neighbor as a competitor for space. I have never seen a bird in possession of its egg or young vanquished by these fights but once these possessions are lost a bird will not long try to hold its place in a crowded group. With both sexes participating in incubation and brooding there seems to be no sex recognition apparent in these social activities among incubating and brooding birds.

EXPERIMENTS IN 1931 AND 1934

In 1931, at Wolf Bay, I conducted experiments to substantiate observations in determining the bird's ability to recognize its egg from others in the colony. The following quotation from my notes taken in the blind on July 17, 1931, gives an account of the reactions of birds to an experiment involving three eggs which were chosen for the experiment because of a somewhat similar size and coloring. The three eggs were marked, X, Y, and Z from right to left. The positions of the eggs were carefully noted and then X and Y were interchanged. The owner of X egg was a 'white-eyed' individual which aided in the identification of the birds, as after the eggs were moved the one of the 'white-eyed' bird was in line between the others. The field notes taken at the time are recorded.

10.45 a. m., in blind prepared to stay until tomorrow; windy; clouds promise to clear. 4.00 p. m., several times a Murre has approached the eggs but turned back. 4.30 p. m., 'White-eye' came into the crevice, looked at the three eggs, and directly hovered her own although I had moved it about eighteen inches and changed positions with another marked Y. She has now moved it over to the old location and is close against the one, Y, which I placed in her old location, in fact has her egg standing on end against Y. 4.50 p. m., 'White-eye' has moved her egg into its identical old position without any intentional movement of the other egg, but she has gradually crowded it out of the way (farther from its original location) and now occupies her exact old position and sits facing the same direction she did when I observed her day before yesterday. 5.15, the owner of Y egg came into the crevice, went to her old place between 'White-eye' and Z; there she squatted as to hover, just as if the egg were present. After a moment she went around behind 'White-eye' to the new location of her egg, identified it, and hovered it there for a moment. Then she left and went back to the old nest site, repeated this twice, picked a fight with 'White-eye,' preened herself, and fought again more severely. Then she returned again to the egg and after hovering for a moment began moving it a little at a time through a narrow passage between 'White-eye' and a pool of water toward the old nest site. The egg was moved after it was placed in the incubation spot among the belly feathers and held there

because of being above and between the tarsi. In this hovering position the bird slowly moved along until it was back into the old position between 'White-eye' and Z. At 5.35 p. m., all is normal and quiet with X, Y, and Z. Z came directly to its egg while Y was maneuvering.

In the summer of 1934 while working on the St. Mary Islands I twice repeated an experiment similar to the one reported above. While I did not actually observe the birds, the eggs involved in the experiment were in each case returned to their original locations. Thus, it is certain that the Murre does readily identify its egg and that it does have a definite nest site which it prefers to occupy. In colonies which have been disturbed I have seen birds return and find the eggs considerably mingled from rolling. It is not uncommon for such birds to move their eggs back to their original locations for a distance of one to five yards.

OBSERVATIONS IN 1938

On June 27, 1938, a 5 by 7 tent was placed at one side of a large Murre colony where I might remain for an extended time to make continuous observations. After considering the record of the resultant study it seems wise to present it as a whole in order that the data may be later reevaluated by students of behavior in light of their new understandings.

The tent blended well with the surroundings and was protected from wind among the large boulders of red granite which littered the broken surface of the slope. Apparently many of the Murres abandoned their eggs as a result of the disturbance, but by July 6, when I returned to record observations, the colony had settled down, accepted the tent and several pairs of birds were ready to re-nest. This condition gave me the opportunity to observe the behavior of different pairs of birds in various phases of the reproductive cycle, some beginning to hatch and others re-establishing nest sites and courting.

During the three-day observational period the birds were watched throughout the daylight hours and during most of the nights. Since they were only a few feet from my tent I could readily observe them in the semi-darkness during the inactive hours, 10.00 p. m. to 2.30 a. m. In the following record, which is presented with slight editing, numbers have been assigned to several birds in order that their activities might be recorded without confusion. Certain additional birds are occasionally referred to without numbers.

Key to Special Birds Mentioned in Notes

- (1) A 'white-eyed' bird incubating a green egg on slope near tent.
- (2) A plain-colored bird, mate to (1).
- (3) Plain-colored bird first observed incubating an egg broken at the large end with the contents partly leaked out.
- (4) Large plain-colored bird which incubated a broken egg, crushed in on the side and empty, located in the group with the other birds near the tent.
- (5) Plain-colored bird (plumage soiled) incubating a light-colored egg several feet from the tent. This bird adopted a very young bird in addition to its own egg.
- (6) Mate of (5).
- (7) Bird (very small) which produced a fresh egg.
- (8) Bird which continued for two days bringing fish to a certain site and going through the ceremony of feeding young although no egg or young was present (identified by its action and its nest site).

THE RECORD

July 6, Wednesday

4.00 p. m. I am established in a tent on Fox Island ready for an extended period of observation of this large Murre colony. Many of the eggs appear to have been lost but a few are beginning to hatch.

5.30 p. m. The birds are returning to their eggs. One bird (3) is hovering an egg with the large end broken out and the egg half empty. A 'white-eyed' bird (1) has claimed a green egg and is incubating. A stranger attempting to mount No. (1) was driven off. Another bird (4) is hovering less than half an empty shell while its mate stands by its side preening at its face, and occasionally picking at the shell.

One pair has apparently lost their egg but they still claim the nest site and there they fondle with a small piece of shell less than one-inch square. The one bird straddles the nest site, places the small shell fragment under it, then the other reaches for and fondles the fragment, preens and bills its mate, but neither is content. (Note—I later decided that this was normal courting ceremony.)

6.30 p. m. No. (4) with the half-shell moves it about over two square feet of territory. It is not satisfied with the way the shell fits its belly and the restlessness is reflected in its mate which continues to bother.

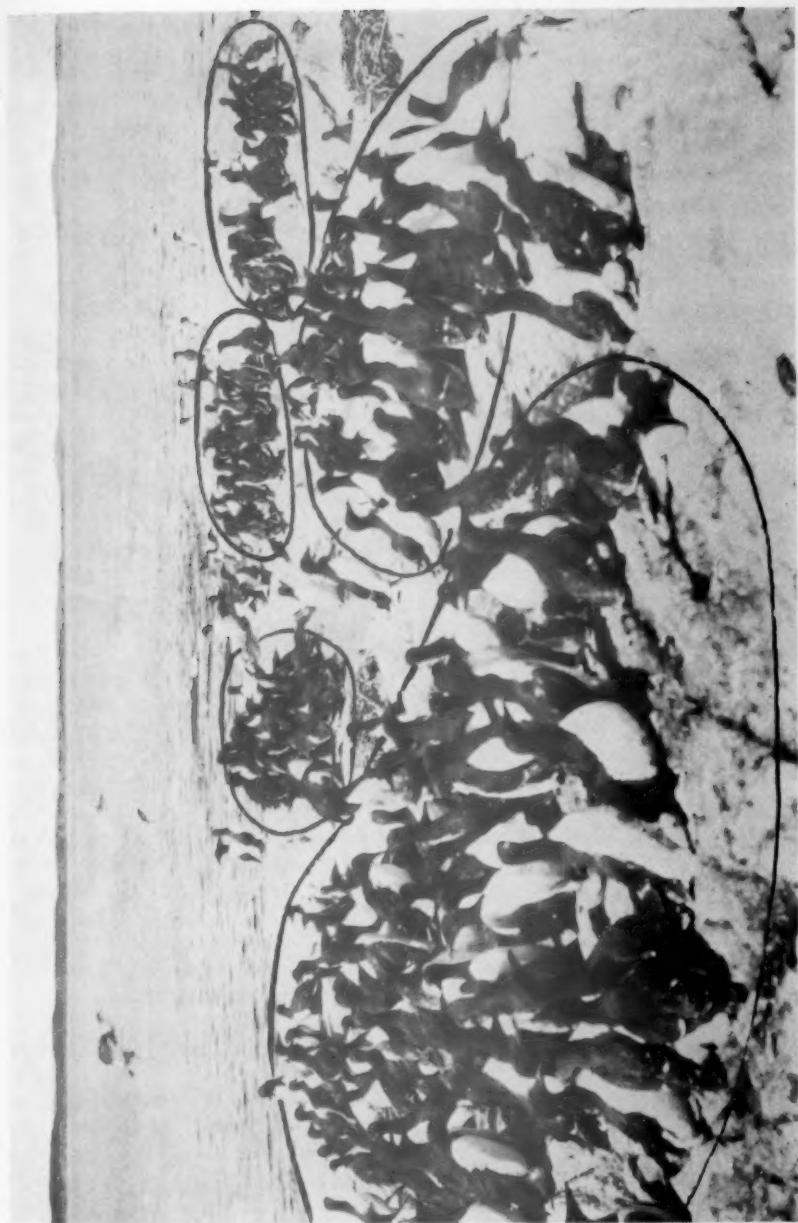
No. (3) which has an egg with the large end broken sits rather steadily only turning it occasionally. The egg appears to have lost one-half or more of its weight and the embryo has bled on the adult's feathers.

7.20 p. m. The Murres are fairly quiet. The two birds remain on their broken pieces of eggs.

9.10 p. m. Because of fog it is now dark and the birds cannot see their eggs. No. (4), with the half-shell, has just left the colony flying to sea. All unoccupied birds are gone now for the night. (This shell had become so flattened that the bird could not feel it satisfactorily and when darkness made it impossible for it to see the shell it apparently gave up and went out to roost with the unoccupied birds.)

July 7, Thursday

3.30 a. m. No. (4) is gone. Part of the shell still remains. No. (3) remains on duty. No. (2), mate of 'White-eye' is here preening its (1) face but gets little response.



GROUPS OF MURRES IN A NESTING COLONY

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6.30 a. m. No. (2) has taken over the green egg and No. (1) has gone. Birds are coming in rapidly with capelin.

9.00 a. m. The mate of No. (3) came in at 8.30 and offered to take over incubation duty but was refused. It has gone now. No. (2) has taken the flattened piece of shell formerly claimed by No. (4) and is using it for nesting material. Any object of convenient size that is available is frequently being picked up and moved about. Interest in these objects soon ceases and they are picked up by an adjacent bird.

(Note—In 1934, I noticed in certain small colonies nesting on gravel-bottom caves which at times flood to a depth of one or two inches, that sometimes an incubating bird will have built up the level of its nest site by this process of reaching for small rocks and dropping them at its breast, so that the egg is actually on a small built-up island and thus survives the temporary flood and accumulating filth about it. In this case such activity has functional value as nest building but ordinarily it seems to be only ceremony. Perhaps we have here an insight into the way nest building began in the first place among other species.)

An adult which moved its small young up the slope to a location near my tent became frightened and left the little one. It, wet and cold, soon began to cry and move about. A strange adult came near to it and when it cried, would carefully take its beak between her mandibles. The little one tried several times to push itself under the adult to hover but the old bird seemed not to understand, appeared afraid, and would not hover the youngster, yet, when it continued to cry the adult returned several times and billed it. Finally the young rolled over down the incline about four feet against another incubating adult. There it tried to get under this adult but was repulsed.

Many unattended eggs have rolled down the incline and are half buried in a pool of filth.

10.00 a. m. No. (2) took charge of the green egg at about five o'clock this morning and now has the egg upon its foot and tarsus entirely off the rocks. Birds do not always keep the eggs off the rocks. It is surprising that with so large an egg they can close the feathers entirely about it. They do this when they settle down as in the evening.

(Note—I believe the peculiar shape of the Murre egg is explained by the fact that it is thus easier for the bird to bring a larger surface area in contact with the belly during incubation. Considering the large size of the egg in relation to the bird this is important and is, I believe, of much more functional value than the advantage the shape gives the egg in keeping it from rolling to destruction.)

11.30 a. m. No. (8), a bird which has been around here before, now is standing where it appears to claim a nest site. It has been there for some time with a fish and occasionally holds the fish's tail down between the tarsi repeating the ceremony of offering food to a small young. No young or egg is present. After several minutes the bird flew with the fish, and went out to sea.

12.00 m. The adult which left its young this morning has returned, recovered the young from the mud and has it fairly well dried. No. (3), the bird with the broken egg, has just left the colony. The broken egg is well flattened now. This leaves No. (2) alone of that group of birds. When No. (3) left, No. (2) stood in an uncertain manner for a few moments, but decided to stay with the egg.

1.00 p. m. The gull flew over and called. This frightened the adult with the young. It flew, upsetting the young which rolled several feet landing against No.

(5), which seems receptive although it has been occupied with its own egg since early morning. Soon the parent returned and fought the innocent No. (5), securing the young one under its wing again. But the gull returned again whereupon the parent was frightened away the second time. After about ten minutes of crying and pushing against No. (5) the young has been accepted under the wing of No. (5) where it is being hovered beside the egg. (Note—This is the first case of adoption I have seen in three summers' observations.) We shall see what may happen when the real parent returns.

1.30 p. m. No. (3) has returned and is incubating the shell although it is less than half the thickness of the original egg.

2.15 p. m. No. (4) which had the half-shell last evening and abandoned it at dark has reclaimed another similarly colored egg from the half-buried lot in the mire and has moved it about twelve feet to the location where last evening it hovered the shell.

3.30 p. m. For the past hour this colony has seemed to be in chaos. Many birds are trying to claim new nest sites and courting. These are the birds which, no doubt, lost their eggs as a result of the disturbance when my tent was placed. The colony is sensitive to gull warning and has suffered considerable loss. The young one is still with its foster parent, No. (5). I do not believe that it has been fed today.

5.15 p. m. The great mass of unoccupied birds here, courting and struggling for nest sites, indicates that the colony is about to be renewed and supplied with many more fresh eggs. Some of the birds are now sitting quietly on their chosen locations and the few incubating birds which I have been watching since yesterday are mostly quiet throughout today.

A pair of courting birds nearby have chosen their nest site. They are typical as they stand shoulder to shoulder and change possession, again and again, of a small piece of seaweed keeping their beaks down nearly to their feet. Frequently one utters a series of notes, as, *ya, ya, ya*. Then one preens the other's face. Again they lower the heads and repeat the *ya, ya, ya*. Occasionally they lower the breast on the rocks in a manner similar to a posturing mood while they tread with the feet in a distinctly scratching motion. I can hear their toenails scratching on the rock. Each bird of the pair performs this scratching act, sometimes in succession, sometimes not.

8.45 p. m. The young Murre is still under No. (5), the bird with its own egg; it has not been relieved today. The young cries considerably the past two or three hours. Perhaps it is hungry with no food today. Four adults, I think, have not left their eggs today. No. (2) has been here since about 4 a. m., without food sixteen hours at least.

July 8, Friday

3.30 a. m. Daylight has been coming on for fifteen minutes. The gull has just been here and cleaned up every egg out of reach of the Murres. It took the contents out of the egg which No. (4) had retrieved from the mire.

4.00 a. m. A few minutes before four o'clock No. (1) returned to take a shift on the egg. After fifteen minutes of preening about the face and the throat No. (2) stood up and flapped its wings. No. (1) tried to take the egg but No. (2) was not ready to leave. A little more billing and No. (2) stood again. Then No. (1) reached under No. (2) and took the egg with its beak while No. (2) backed slowly away. After approximately twenty-four hours of duty No. (2) left the colony.

A new bird, No. (7), came in with a small fish in its beak and took up a location near No. (1) on the flat surface where I saw it sitting yesterday. For an hour it has been quiet with the fish protruding from its beak.

5.30 a. m. About 4.30 No. (6), the mate to the bird with the adopted young, came to relieve No. (5). Twenty minutes of ceremony were required to effect the exchange and now No. (6) has taken over egg and young.

7.00 a. m. No. (7) has just produced a new fresh green-colored egg. She is still holding the fish in her beak. No. (4) has returned and is hovering the empty shell of the egg from which the gull took the contents this morning. No. (7) has just now discarded the fish which she held in her beak for nearly four hours and has stayed with her egg during a gull fright when many other birds left the colony.

10.00 a. m. No. (5) is back trying to feed the adopted young a fish as large as the bird. It cannot take the fish. During a gull fright No. (7) left her fresh egg and it rolled down the slope into the mire about twelve feet away where it seems lost. Soon No. (7) came back to the empty nest site.

11.15 a. m. No. (7) is having trouble holding her empty nest site with many courting pairs crowding about.

12.00 m. The bird which was bringing fish to an empty nest site and going through feeding ceremonies yesterday is repeating the act today.

12.30 p. m. Here is a typical courting pair going through the entire ceremony (a mixed pair, one a 'white-eyed' bird mated to the plain-colored type). Their behavior is typical and may be described as follows: the two birds crowd close together, side by side, on their selected nest site surrounded by other pairs. One bird does the scratching act (described above). Occasionally they fence rapidly with the beaks partly open, the mandibles clashing together in rapid side movements while both birds squawk. Then one scratches the ground while the other presents a piece of nesting material which is ignored. Then, they crowd closer together and arch the necks in a manner to bring the heads down under the breasts. The one which I assume to be the male tries to take the other's beak in his but not to hold it, only pretending while he utters a series of calls: *auoooooooo—, quack, quack, quack, quack*. This *quack* note may have two, three, or four repetitions and the first note is long drawn out. Following this, the female usually shakes the head. Sometimes the male does also. Often they bill repeatedly with the beaks down under the breast of the female as if concealing them. Often the (female?) has the feathers on the head and neck raised, the eyes partly closed and shows some movement of the nictitating membrane. This continues for hours.

2.00 p. m. No. (2) has just returned and made attempts to take over the egg. At the moment a gull fright gave No. (2) a chance to get on the egg. No. (1) billed for a moment and left the colony having completed ten hours' duty. Its mate did twenty-four hours' duty before that.

3.15 p. m. The egg of No. (5) is beginning to hatch. This means that her incubation cycle was about complete when she adopted the orphan.

8.00 p. m. The ranks of the courting birds have thinned out somewhat but a few are still 'going strong'. In the case of one pair I have recorded the vocal response to the call described above, thus: one birds calls *ya, ya, ya, ya, cahoooooooo—*; the other bird answers, *auooooo, quack, quack, quack, quack*.

8.15 p. m. No. (2) is back on the egg. She left at 2.00 o'clock. I did not see her return.

9.00 p. m. Darkness is approaching but about a dozen pairs of the courting birds are still on the nest sites which they have been holding most of the day.

July 9, Saturday

3.30 a. m. There was some movement in the colony between 2 and 3 o'clock, but now several courting pairs are back at it.

4.30 a. m. The colony is crowded with courting pairs. Several birds hold fish in their beaks but seemingly without any purpose.

5.00 a. m. No. (1) is on her egg. This pair of birds never have left their egg regardless of the movements of others. (Note—Normally a Murre egg is never left unguarded. This is, of course, the explanation for the species' being able to use relatively steep inclines for nest sites. When one bird relieves the other from duty the egg is taken over by the incoming bird in such a manner that it has no chance to get away and roll except by accident.)

6.00 a. m. A storm is approaching and I am now leaving the blind after a continuous study of over sixty hours except for five hours of darkness during the nights.

SUMMARY

1. The Murre is a social bird in its nesting colonies, easily and adversely affected by fear.

2. In the Cape Whittle region of the Gulf of St. Lawrence, the nesting islands are flat, of granite with wide faults or crevasses for nesting places. Many large colonies are located on the flat surface of islands, sometimes among nesting cormorants, sometimes completely exposed. The structure of a nesting colony consists of a confederation of groups of birds. Each group tends to show concentric formation according to laying dates.

3. The daily activities of the breeding birds take place in three functional areas: the area of the breeding sites, the loitering ground, and the feeding area.

4. A pair of courting birds practice a certain ceremonial behavior at the nest site. With some variation in the sequence and completeness of different acts, the ceremony includes vocal notes, movements of the head and body, preening, erection of head- and neck-feathers in at least one sex, scratching with both feet while the body rests on the breast, billing, crowding and exchanging possession of small stones, sticks or bits of seaweed. One bird was observed showing movements of the nictitating membrane.

5. Courting birds often carry food fish to the nest site and there hold them in the beak from one to four hours. This behavior appears to give satisfaction to the one bird only. I have never seen another bird appear to notice these fish. Courting pairs are likely to remain at the prospective nest site for many hours at a time for a few days before ovulation.

6. In a few cases where birds nested in gravel-bottom crevasses which at times flood to a depth of one or two inches and collect pools of liquid filth, I have seen nest sites built up and the eggs thus saved by being on a small island formed as a result of the incubating bird's reaching out from her nest site and securing small stones which were in turn dropped near her breast. When one observes the bird doing such nest building (if it may be called nest building) the result appears entirely accidental because the bird does not seem to retain interest in the stone long enough to place it with any purpose. Other birds, if near, are likely to disperse these stones. But the fact that there is a tendency for some birds to accumulate materials indicates that there is some direction to the birds' movements and this may be the beginning of nest building in a species.

7. Experiments show that Murres do easily identify their eggs even when they show only slight differences and when moved some distance from the nest site. Eggs out of place are returned by their owners to the old nest site, and are usually completely ignored by strange birds. Two different pairs of birds at different times incubated broken eggs and empty shell or pieces of shells. This indicates that the birds may rapidly adjust to a change in the character of their egg. One bird was observed to adopt a strange abandoned egg of similar color to the old shell formerly cared for.

8. One incubating adult adopted a small young. This foster parent was incubating a piped egg at the time. In many other similar situations I have seen small young left to cry and chill but they have always been ignored or repulsed by surrounding adults except in a case where the adult was frightened by man and thus allowed young birds to take refuge under its wing temporarily (see Auk, 35: Plate 5). After about four days of age, young do not approach strange adults.

9. Definite feeding ceremony is used by adults in offering food to young; and adult birds having lost a piped egg or small young have been observed to return to the old nest site and perform the food-offering ceremony for a period of two or three days following the loss.

10. A ceremony of social preening and crowding is used when a bird takes over the egg or young from its incubating mate. These ceremonies are not always successful. Both birds do duty with no regular interval for exchange; but 16 to 24 hours of duty is not uncommon.

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'WHITE-FACED' TERNS

BY RALPH S. PALMER

Plate 7

DIFFERENT plumages of the same species of terns have been given new names so many times that the Marples have included in their book on 'Sea Terns' (1934: opp. p. 23) a plate labelled "Comparative Diagram of the 'Spurious' Terns." One of the birds shown is the non-breeding 'white-faced' Arctic Tern, *Sterna 'portlandica.'* While conducting a behavior study of the Common Tern (*Sterna hirundo*) on the Sugarloaf Islands, at Popham Beach, Maine, the writer has collected and observed both breeding and non-breeding 'white-faced' examples of this species. Since the significance and occurrence of 'white-faced' plumages in terns are not generally understood, the writer has undertaken to sum up here the available evidence on plumage sequence in the Common Tern. While most of the facts presented refer specifically to the Common Tern, they apply equally well to the Arctic and, in many respects, to the Roseate and other terns.

The writer wishes to acknowledge the assistance he has received from the following institutions and individuals: the authorities in charge of the U. S. National Museum and Biological Survey collections, the authorities of the American Museum of Natural History, and Mr. Arthur H. Norton of the Portland (Maine) Society of Natural History for the loan of valuable specimens. Professor S. A. Asdell, of the Department of Animal Breeding at Cornell University, has kindly loaned the writer many reprints from his files and has made helpful suggestions pertaining to the endocrine aspect of plumage sequence.

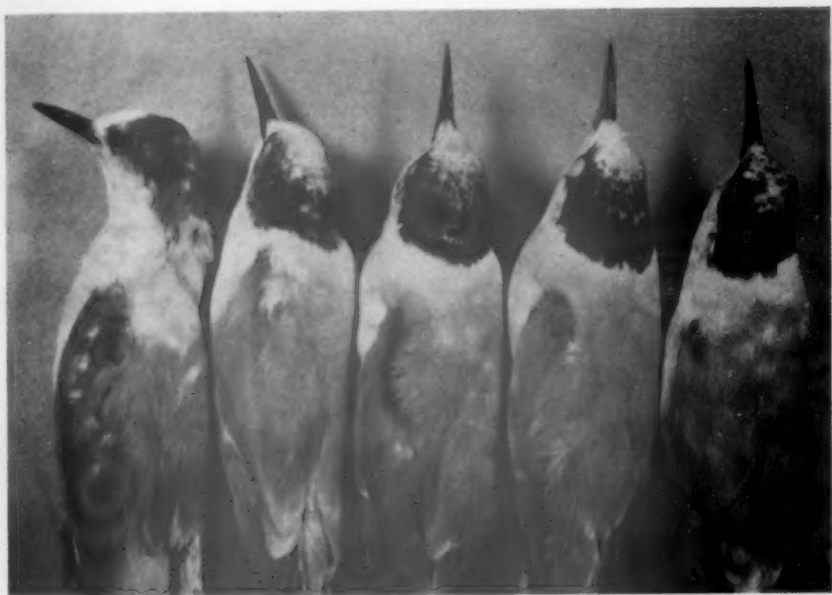
EXPLANATION OF PLATE 7

Common Terns—The left-hand bird is a juvenal and can be so recognized by the markings on the back. In other respects it is much like the next two specimens, which are summer non-breeders in fresh eclipse, i. e., '*portlandica*,' plumage. The two right-hand birds are old-age breeders. The nature of the cap and the color of the bases of the bills at once differentiate them from '*portlandica*' specimens.

Arctic Terns—The left-hand bird is the type of *Sterna portlandica* Ridgway. It is badly soiled and does not show the cubital wing band very well in the plate. The next two are also summer-eclipse or '*portlandica*' birds. The fourth is an old-age breeder of the '*pikei*' type. The fifth may possibly represent either a partial assumption of breeding plumage by an 'immature' bird or a condition approaching old age.



JUVENAL AND 'WHITE-FACED' COMMON TERNS



'WHITE-FACED' ARCTIC TERNS



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RELATION OF GONADS TO BREEDING AND ECLIPSE PLUMAGES

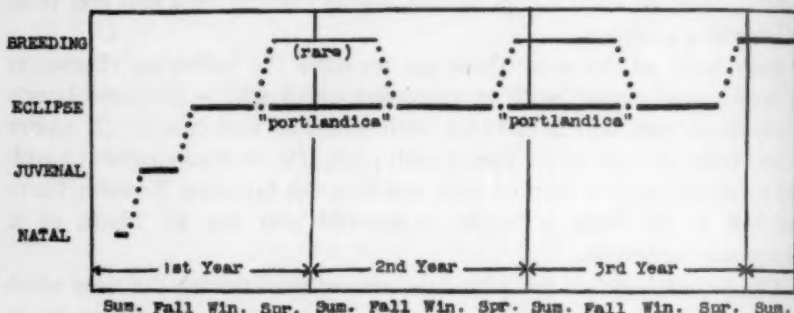
As here used, the term 'eclipse' includes all postjuvenile plumages assumed by certain 'hooded' or 'capped' Laridae when the gonads are quiescent or relatively so. The juvenile stage might also be called eclipse, but it is not so called because this plumage is easily distinguishable from subsequent non-breeding plumages. This definition of eclipse pertains to the species under discussion, since the physiological basis for arriving at equivalent plumages in ducks and other birds is known to differ from that of gulls and terns.

Both sexes of the Common, Arctic and Roseate Terns exhibit the following characters in the juvenile and in the eclipse states: (1) a light forehead and a blackish crown; (2) pure white under parts; (3) a dusky cubital band on each wing; (4) less highly colored bills and feet than in breeding plumage.

Both sexes of the same three species have the following characters in breeding plumage (with an exception which will be discussed later): (1) a black cap, which includes both forehead and crown; (2) under parts either gray or white tinted with pink; (3) no dusky cubital band; (4) relatively highly colored bills and feet (in breeding Roseate Terns the bill at the base is bright orange-red and not all black, as is commonly believed).

The juvenile and eclipse plumages are assumed during the time when the gonads are relatively quiescent. The breeding plumage in at least part of the Laridae is apparently the one dependent upon the secretion of a sex hormone for its development. Whereas this is not the case in many birds, as has been explained adequately by Domm (1939), I feel certain it is true with the terns with which we are dealing because of evidence from castration experiments on the Black-headed Gull, *Larus ridibundus* (Van Oordt and Junge, 1930, 1933a, 1933b). This gull has a plumage sequence and certain secondary sexual characters very similar to those in Common, Arctic and Roseate Terns. It has a 'hood' on the head, as well as bright-colored bill and feet, which are present during the breeding season in both sexes. Characters of this nature have been called 'ambosexual' characters by Champy (1930) and Champy et al. (1931). If gulls of this species are castrated in winter plumage—either first winter or succeeding ones—the nuptial plumage fails to develop. At the time of the prenuptial molt the birds again assume the winter (eclipse) plumage. Furthermore, the bill and feet remain in winter condition. Therefore, the assumption of the nuptial plumage and bright bill and foot color appear to be influenced by a testis hormone which cannot be secreted by castrated birds.

While Van Oordt worked on male birds only, a matter commented on by Domm (1939: 283), he stated that he supposed that ovariectomy would produce the same result, since females and males have similar plumages. The fact that Common and Arctic Terns of *both sexes*, that have very small gonads and do not breed, revert to the eclipse plumage at the time of the spring molt, lends support to his statement. As we shall soon see, Common Terns ordinarily do not breed at an early age, nor do first-year birds appear on the breeding grounds in any numbers. Those which do appear usually have minute non-breeding gonads and are found to be in fresh eclipse plumage which they acquired by a complete spring molt. That '*portlandica*' birds were non-breeders that acquired such a plumage in spring was well



TEXT-FIG. 1.—Diagrammatic representation of the sequence of plumages in early life in the Common Tern. The probable normal sequence is shown by the heaviest line. Dotted spaces indicate, in a general way, times of molt.

understood by Dwight (1901: 52). These birds are, in plumage, equivalent to Van Oordt's castrated gulls.

Just how long a tern may revert to the eclipse stage semi-annually is not definitely known, but it is fair to assume that they do so as long as they stay away from their breeding grounds. The matter can only be definitely settled when many banded non-breeding birds are recovered at various times of the year. In general, the sequence of plumages of the Common Tern in early life appears to be thus: (1) natal (acquired before hatching); (2) juvenal; (3) first-winter eclipse; (4) first-summer eclipse—'*portlandica*' (rarely a breeding plumage is acquired instead); (5) second-winter eclipse; (6) second summer, either: *a*, eclipse again ('*portlandica*'), or *b*, first-nuptial plumage.

Many birds require another year before attaining their first-nuptial stage. The diagram of plumage sequence shows the probable normal sequence up to the fourth summer. It does not show duration of molt.

I have not called the immature summer plumages 'nuptial' plumages, as Dwight (1925) has done with gulls, since the term is more appropriate for breeding stages.

The Common Tern resembles some of the smaller gulls much more closely, both in time of beginning to breed and in time of assumption of breeding plumage, than many writers have heretofore realized. The following data will make this clear.

YOUNG 'WHITE-FACED' TERNS

Attainment of breeding age.—No Common or Arctic Tern appears yet to have been recorded with absolute certainty as breeding in any form of immature 'portlandica' or eclipse plumage. Colonies of Cabot's and Sandwich Terns (races of *Thalasseus sandvicensis*) and Royal Terns (*T. maximus*) have a fair share of the breeding population showing white in the foreheads. These lighter birds appear to be first-year birds and are quite definitely known to breed in this plumage (H. W. Robinson, 1910, 1940). One Sandwich Tern in "full winter plumage" has been seen to incubate an egg (Robinson, 1940: 150). The Black-headed Gull breeds regularly in "immature" plumage (Kirkman, 1937: 111). Haverschmidt (1931) mentions the same fact and also states that the Herring Gull (*L. argentatus*) and the Lesser Black-backed Gull (*L. fuscus*) breed before attaining the fully adult stage. Tinbergen (1936) reported that immature Herring Gulls may pair, nest and copulate, but fail to lay eggs. Many sub-adult Larinae very commonly 'play' with nesting material at the season when adults are breeding. Juvenal Common Terns often pick up grass and twigs on or near the territory where they were hatched, but the reason for their so doing is not clear.

Whereas the Marples (1934: 120) stated that Common Terns normally breed when one year of age, the Austins think otherwise. O. L. Austin, Jr., (1929: 130) concluded from his very extensive banding and retrapping records that this species does not breed at the age of one year, that all do not breed when two years old, but that the third year normally sees them productive. Later, O. L. Austin, Jr., (1932: 137) reported capturing a single year-old Common Tern which was incubating eggs. Since nothing was said to indicate otherwise, we may assume that it had attained the breeding plumage and that it had a definite connection with the eggs. Thus it seems that the Common Tern may rarely breed when one year old.

From the facts that year-old birds are rarely retrapped at nests, that few two-year-old birds are taken, and that the birds are usually in their third year when first recaptured, we must come to one of two

conclusions: either (1) the young birds do not breed, or (2) if they do, they nest in other places rather than near the colony where they were banded as nestlings. Since the Austins have concluded from their data based on a number of Cape Cod colonies spread over a considerable area that Common Terns tend to return to breed "in the general vicinity" of their natal homes (O. L. Austin, Jr., 1929: 128), and since it is well known that once they begin to breed terns tend to come back to the same nesting site annually, we are faced with the first alternative, namely, that young birds do not breed. Furthermore, banding returns from more distant colonies in no way conflict with this conclusion.

Distribution.—There are relatively few data as to where non-breeding year-old and two-year-old Common Terns are to be found, although Lincoln (1927) published a small amount of evidence based on banded birds. Thousands of juvenals go south with their parents annually. Do they tend to wander like year-old Herring Gulls? This seems very likely. This wandering probably takes place in the tropics or even farther south. Many writers, such as Ticehurst (1924: 140), have stated that more southerly *summering* birds were in the 'portlandica' plumage. Such wandering might also account for the fact that several Common Terns, which were taken in the Antarctic regions, were referred to by Murphy (1936: 1099) as "birds of the year."

O. L. Austin (1938: 13) has attempted to account for young birds by considering them as "drones," or idle birds near breeding colonies. My own work in relatively small colonies (350 to 500 pairs of birds) does not favor this concept, but rather shows that the birds which gather in rows and flocks near colonies are *breeders* and that they are indulging in what may be called a social sunning reaction (Watson, 1908). Terns are social creatures and this tendency to become a member of a flock manifests itself frequently all during the breeding season. However, once a tern leaves a flock and flies to the nesting territory, it becomes strongly territorial in its reactions. Thus these idle flocks are, in general, made up of mature breeding birds in normal breeding plumage and not of "drones" or young non-breeding terns. A few exceptions will be discussed later.

As the mating season advances we find a sort of floating population, but this consists of birds that have lost their eggs or chicks and so were breeders when they arrived in the colonies.

Gonads and migration.—Putzig (1937) and Hann (1939) have shown that a total of five species—two gulls and three passerines—will migrate southward after castration. Therefore, their urge to undertake this migration is not dependent on the presence of male gonads. Of course,

when one stops to think about it, this does not seem very unusual, for the young of certain species whose gonads have never enlarged, migrate southward successfully even without accompanying adults of the same species.

The spring migration is another matter. It is indeed interesting that a few non-breeding '*portlandica*' terns, with their very minute and undeveloped gonads, should come northward at this season. Apparently terns tend to be social all the year round and these few young birds return to the breeding colonies not because of any urge to migrate within themselves, but because they happen to associate with normal migrating individuals.

OLD-AGE 'WHITE-FACED' TERNS

Longevity.—O. L. Austin, Jr., (1932: 139) stated that the 'average' length of a Common Tern's life was somewhat less than nine and a half years. Flower (1938: 224) reported the average life span for twenty banded terns of three species as eight years and nine months. Considering the great age attained by some of their gull relatives, it is not surprising to find that many terns live well beyond their average span of life. Cooke (1937: 55-56) reported twelve-year-old Common Terns, nine-year-old Arctic Terns, and seven-year-old Roseate Terns. The Austins find thirteen-year-old Common Terns quite regularly, and these appear to show first the old-age 'white-faced' condition. The Marples (1934: 123) quoted from Trans. Norfolk and Norwich Nat. Soc., 1922, an interesting case where a Common Tern nest was found on the same site for seventeen consecutive years, and contained "very distinctive unspotted eggs." The bird was killed by a stoat in 1920 and similar eggs have not been found there since. If this bird did not breed until the second or third year, it had attained altogether an age equal to double the average life span for the species. A banded Black Tern has been recovered in Italy at the age of at least eighteen years (Schenk, 1934: 69).

There is little evidence that birds past breeding age form part of a breeding colony. There are few idle birds of any sort present. The specialized mode of life and the long migrations which terns undertake insure that less vigorous individuals are weeded out and do not survive. The case appears somewhat different with Kirkman's Black-headed Gulls, for he states (1937: 62) that there were birds too old to breed present in the Twigmoor gullery and that they were easily recognized by their "dilapidated plumage" and "general air of feebleness." He further points out that these birds excite hostility and attack from more vigorous individuals. Since this species is fed

in parks and about cities in Europe, and is not a highly migratory one, individuals stand a better chance of surviving to past breeding age than do any species of terns.

Plumage.—O. L. Austin (1938: 21) has reported that thirteen-year-old breeding Common Terns show certain plumage changes, such as a "marked whitening of the feathers on the crown," which renders these birds easily recognizable to an experienced bander. He gave no further details regarding the appearance of these birds. The writer, however, has observed and collected birds in this plumage and has examined others in various collections. At the prenuptial molt these old birds (Common, Arctic, and probably Roseate Terns) acquire the following characteristics: (1) white, or at least lighter, under parts; (2) a white or mottled forehead and black crown; (3) a dusky cubital band on each wing; (4) highly colored bills and feet.

Characteristics 1, 2 and 3 are shared in a general way by old-age breeders with the juvenal and all eclipse stages. In contrast to the others, however, the old birds are definitely known to *breed* (Austin, *loc. cit.*); they have bright bills and feet, and the precise nature of the light and dark feathers of the cap is quite distinctive. They have striking characteristics of both non-breeding and breeding birds. This plumage appears to be comparable to the *Sterna pikei* of Lawrence (1853), which Ridgway (1875) separated from '*portlandica*' on the basis of colors of soft parts. Both birds were Arctic Terns.

The blackish crown of juvenal and eclipse Common, Arctic and Roseate Terns has a rather washed-out appearance, and merges very gradually into the forehead. In 'white-faced' breeders it appears as if a cap as black as that of younger breeding birds had been assumed, then the forehead part of it shed and replaced by pure-white feathers. This is exactly the appearance of the heads of younger breeders when they begin to assume the eclipse plumage in September. However, with these old birds all the feathers of both forehead and crown seem to be of an equal age in May, June and July specimens. Both sexes have this plumage, which is not merely an early onset of the fall molt of younger breeders.

In the case of skins of some summer individuals which I have examined, that have black feathers scattered throughout the light forehead and yet otherwise resemble old-age terns, I am not certain but what this intermediate plumage may represent young birds in a first imperfect breeding plumage. However, it might equally well represent an onset of the old-age condition. There are no published data from banders dealing with this matter.

Possibly a sex hormone influences plumage by its presence or ab-

sence. These terns, as they approach old age, show characteristics of the non-breeding plumages. There may be a differential threshold of amounts of hormone necessary for the assumption of (1) the bright colors in bill, legs and feet, and (2) the full normal breeding plumage. The birds are able to breed when they do not produce the full breeding plumage.

Whether or not Sandwich and Royal Terns have an old-age 'white-faced' breeding plumage appears to be unknown. If different species of terns do have this plumage and acquire it at different ages in each species, the facts might be determined by banders.

It is well known that birds in captivity or in a half-wild state show plumage changes of various sorts when they become old. Millais (1902: 17) has recorded such changes in both sexes of the Mallard, but these changes appeared after the birds passed breeding age.

Numbers.—Neither the Austins nor the Marples have reported on the numbers of 'white-faced' terns in the colonies which they have studied. After '*portlandica*' was described, the bird was stated to be "of rare occurrence" in such lists as that of Brewer (1875: 450). Coues wrote about the bird several times, but said little or nothing of its numbers. Hersey (1920: 203) stated that many Arctic Tern colonies had no so-called Portland Terns, while other colonies contained a "considerable number." Dwight reported one '*portlandica*' bird to a thousand normal breeders in the large Sable Island, Nova Scotia, colony. Upon examination of his series I find that one of his Sable Island 'white-faced' terns is in the old-age and not the '*portlandica*' plumage.

At the Sugarloaf Islands I have noticed about one 'white-faced' bird (including both sub-adult and old-age terns) to 150 pairs of ordinary-plumaged breeding Common Terns during the summers of 1938 and 1939. Immature and old-age birds were about equal in number in these small colonies. I rather suspect that the latter would predominate if the colonies were older, but they have had an interrupted existence, and the present population began to colonize the islands about 1923. Some Maine gunners of a past generation were familiar with birds with light foreheads, and referred to them as 'White-faced Medricks'.

By the time that the banding of nestlings and the trapping of banded adults has progressed beyond the extreme life probability of terns in a number of large colonies, it should be possible to construct a histogram showing the relative numbers of each age class up through the old-age 'white-faced' stage. One could then ascertain with reasonable mathematical accuracy the relative numbers of 'white-faced'

breeders for a colony of any given size. O. L. Austin, Jr., (1932: 137) has prepared such a histogram covering eight years' work, but this is not long enough to provide data on old birds. The eclipse-plumaged birds are not truly migratory, hence their numbers are not predictable.

Behavior of 'white-faced' birds.—Dwight (1901: 52–53) reported that attention was often drawn to the '*portlandica*' Arctic Terns on Sable Island, Nova Scotia, by their "single harsh croak seldom uttered. . . ." They must, indeed, have been conspicuous, for he succeeded in getting eight 'white-faced' specimens. Holder and Wagstaffe (1928) reported seeing a few non-breeding Common Terns each summer for several years on the South Lancashire coast, where the birds possessed some of the pugnacity of adults and occasionally would swoop at humans on the beach. The few '*portlandica*' Common Terns which I have observed have usually been silent. I have not noticed that they were unusually conspicuous in a colony insofar as they themselves were concerned, but they were sometimes followed about by several breeding adults as Barn Swallows pursue an albino fellow member of their species. Breeding terns seem to recognize these non-breeders in summer-eclipse plumage as not being part of the breeding colony. Perhaps non-breeders fail to indulge in the formalized posturing of sexually active individuals.

Austin (1938: 21) has pointed out that clutches of eggs of 'white-faced' Common Tern breeders are of average or larger size, and that fertility seems to be normal. These old-age birds are not very conspicuous, nor are they accorded different treatment by younger breeders, as can be seen from the following extract from my records made from a blind on July 2, 1939:

A white-faced bird came and stood on a common perching rock within sight. It called to passersby; would face in one direction, then in another. Bird has orange in bill and highly-colored feet—much different from white-faced bird I collected in June. No other bird paid any noticeable attention to it.

Another bird standing by a nest not far away has a number of white feathers in the forehead. It is mated to a bird with an all-black cap.

Thus it seems that old breeding birds with white foreheads find that a whitening about the 'brows' is no drawback to acquiring a mate, or in participating in any phase of the normal breeding cycle. They are as readily accepted for mates, as long as their *behavior* is suitable, as are the oddly plumaged first-year male American Redstarts (*Setophaga*).

I have no field data on old-age Arctic Terns. The 'white-faced' birds known to be breeding and seen by Lord W. Percy in Siberia and by Jourdain in Spitsbergen, which were mentioned by Witherby

(1924: 713, footnote), were almost certainly of the old-age type which I have discussed, and not true '*portlandica*' examples.

SYNOPSIS OF COMMON TERN PLUMAGES

Much of the data here presented are supplementary to the material in Dwight's paper (1901).

Natal plumage.—The thick natal down which chicks wear at hatching is replaced by a complete postnatal molt. The natal down of Roseate Terns has a distinctive spinous character, like that of *T. sandvicensis*. Natal Common and Arctic Terns show a wide variation and cannot always be distinguished from each other. The throat of Common Terns ranges from white to black, but is usually quite dark. The forehead is generally light. Natal Arctic Terns usually have a dark throat, and this color extends up and across the forehead, but those skins showing a light forehead cannot be separated with certainty from Common Terns. The natal down is pushed out gradually and there are usually only traces of it left about the head and flanks when the juvenals begin to fly between the ages of 27 and 32 days.

Juvenal plumage.—The crown in juvenals is whitish or pale buff, usually grading rather gradually into the rather dark crown. This can be seen in the juvenal Common Tern shown in the accompanying plate (Plate 7). The back exhibits a widely varying pattern from bird to bird. The ventral surface is white. There is a dark cubital band on the wings. When Common Terns are a week old and still downy, the bill is usually light flesh-color at the base and blackish toward the tip. This color usually brightens as the birds grow older, and is more or less orange-red in flying juvenals. After the birds have been flying about two weeks (i. e., about September 10 in Maine), the bill begins to darken and in a short time it is practically black—in first-winter condition. However, the bills of a few individuals never brighten thus in the late pre-flying and early-flying stages. The bill stays dark and is essentially in first-winter condition when these birds begin to fly, or from late August onward.

The feet of natal Common Terns are generally pale. Those of juvenals at flying age range from pale flesh-color through a brilliant orange to nearly black. Chamberlain (1939) has reported a wide range of color in the legs of young Royal Terns. Like the bills, the feet tend to brighten, then later grow dark and are practically black during the first winter. Also, as with the bills, some feet are blackish long before the birds fly. It is important that banders should realize that dark-footed flightless young exist, for some banders of limited experience, who work in mixed colonies of Common and Roseate

Terns, use leg color to distinguish juvenals of the two species. It is not wise to assume that all dark-footed young are Roseate Terns, since some may be Common Terns. Natal Roseate Terns are easily recognized, while juvenals of this species have fine markings on the back and a generally different 'look' from Common or Arctic Terns. There is a close association between intensity of leg and bill color in individuals of all ages.

The heaviest Common Terns which the writer has weighed have been September juvenals. Floyd (1927) and Heinroth (1928) have provided some data on weight and growth rate of young terns.

First-winter eclipse plumage.—Dwight (1901: 54) stated that the first-winter (eclipse) plumage is acquired by a partial postjuvinal molt, limited mainly to the body feathers. Some individuals may not molt at all (Witherby, 1924: 710) and so retain a worn juvenal plumage throughout the winter. Birds in first-winter eclipse plumage have white under parts, a dark cubital band on the wings, a whitish forehead grading into the blackish occiput, and dark bills and feet.

There seems to be no certain way of distinguishing between first and subsequent eclipse stages. Judging from museum skins, it appears that eclipse birds having some color in the bills and feet are probably breeders in winter condition, and that they do not lose as much of the color then as do younger birds which had less color to begin with. One should be careful in accepting statements pertaining to birds seen or collected in 'first-winter plumage' unless the birds actually were banded and their ages known. Tern skins retain the colors of soft parts very well, but after ageing for a few decades in museum cases there is a noticeable deterioration, perhaps caused by grease in the skins.

First-summer eclipse plumage.—The first spring molt, which is a complete one, is thought to start later and end later than succeeding ones. This molt may be followed by a nuptial plumage in a few individuals. Usually the birds assume the eclipse again, both in feathers and in soft parts, and apparently cannot be separated with certainty from eclipse birds of any age.

I have already pointed out that O. L. Austin, Jr., (1932) recorded capturing a year-old bird on a nest, also that it is possible that an imperfect breeding plumage may sometimes be assumed by some young birds.

Second-winter eclipse plumage.—After a complete fall molt the birds repeat the eclipse again. We may be certain that this molt takes place because (1) older birds have a complete fall molt, and (2) because available 'white-faced' birds do not show the extreme amount of wear

exhibited by late-winter examples that failed to shed their juvenal feathers.

In regard to Herring Gulls of this age, Dwight (1925: 188) reported that an "unknown proportion" of second-winter birds reverts to the "first year plumage or a type resembling it," which partly accounts for the large number of "young birds" which are seen or collected.

Second-summer plumage.—Since a few Common Terns breed at this age, it is certain that some then acquire the adult characteristics which I have already listed earlier in this paper. The prenuptial molt, which takes place normally between February and late April, is a complete one, and breeders have fresh feathers in wings and tails as well as new body-feathers. Non-breeders go into the eclipse stage again.

Third-winter eclipse plumage.—Presumably like other eclipse stages.

Third-summer plumage.—All Common Terns appear to breed at this age. The succeeding fall molt begins to be in evidence by early August, when feathers can be seen on the brood-spots. In Maine the tail 'streamers' are shed and the winter cubital bands begin to appear in the majority of individuals before they start southward.

'White-faced' breeding plumage.—If a bird has survived about ten years of breeding life, which takes it well past average age, it acquires the 'white-faced' breeding plumage, which I have already described in some detail. It has also been pointed out how this plumage differs from eclipse birds. Collectors have frequently written "sterile" or "gonads minute" on labels of '*portlandica*' skins, but we do not find this on tags of old-age breeders. They appear to have been considered as normal breeders which were molting unusually early, but I have already shown that another explanation for this 'white-faced' condition is more in keeping with the known facts.

It is not yet known for how many summers the old-age plumage may be worn, nor whether it is acquired at different ages in different species. Skins of Arctic Terns having the old-age type of cap sometimes have rather grayish under parts and so, unlike Common Terns, are not as pale as eclipse birds. Although I have seen summer-eclipse Roseate Terns, I have never seen a skin or live bird of this species which I could refer with absolute certainty to the old-age category.

All the plumages which I have listed are acquired by Common Terns of both sexes. This is probably true of other species also.

SUMMARY

(1) Common Terns usually start breeding when two or three years old. Evidence indicates that non-breeders having small gonads wear only the eclipse type and never the nuptial type of plumage.

(2) Data are lacking as to where the majority of non-breeders are to be found, but probably they are on the winter range of breeders, or even farther south.

(3) Assumption of breeding plumage appears to be influenced by a sex hormone, as is the case with the Black-headed Gull. Some of the smaller gulls and certain terns parallel one another in many respects.

(4) Old birds show intermediate characters between eclipse and nuptial stages, while still being able to breed.

(5) Terns have a long life span, but birds past breeding age have not yet been recorded definitely as occurring in breeding colonies.

(6) Eclipse-plumaged terns in nesting colonies are not treated like breeders by fellow members of their species.

(7) The spring migration is undertaken by a few eclipse-plumaged birds with very small gonads, probably not because of any urge within themselves to migrate, but because they tend to associate with normal migrants and are reacting socially with them.

(8) Both sexes of the Common Tern acquire the summer-eclipse ('portlandica') and old-age breeding ('pikei') plumage which I have discussed.

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SOCIAL NESTING HABITS OF *CROTOPHAGA MAJOR*

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INTRODUCTION

A STUDY of the social nesting habits of *Crotophaga major* was undertaken as part of a series of researches on the habits of the *Crotophaginae*. The nesting habits of *C. ani* have been described by Davis (1940) and the habits of *Guira guira* have been investigated (Davis, 1940a). The reader is referred to Davis (1940) for a brief summary of the subfamily.

The studies on *C. major* were carried out in British Guiana, in part on Canje Creek near New Amsterdam, but mainly near the source of the Abary River, where, through the kindness of Mr. Albert Reid, I stayed at a ranch. Observations were begun at New Amsterdam on June 9 and continued until June 25. Since that locality was unsatisfactory, I moved to the Abary River and continued work till August 5, 1939. As a result of a series of unavoidable occurrences (malaria, in part) which prevented concentrated investigation until July 10, no nest with eggs was found. Nevertheless adequate data were obtained to elucidate the social nesting habits and territorial behavior of *Crotophaga major*.

A study of the nesting and territorial behavior of this species presents certain practical difficulties to the investigator, because the birds live only along streams. Even though using a canoe at all times, it is frequently impossible to keep up with the birds or to follow them when they go into the thick brush or flooded lands along the river course. Thus deficiencies in the records inevitably result. Although no birds were banded, individual identifications were made on the basis of tail-feathers; for since the molt is continuous, each bird has a different set of tail-feathers.

This study was made possible through my appointment as a Sheldon Travelling Fellow, 1939-40, of Harvard University, Cambridge, Massachusetts.

GENERAL CHARACTERISTICS

This species demonstrates its cuculine affinities by its general behavior and its slow, lethargic movements. *C. major* resembles *C. ani* greatly in its habits of preening, raising the tail when alarmed, sunning to keep warm at every opportunity, and drooping the wings. But it does not appear so dilapidated and unkempt; the wings are usually neatly folded in their proper place and the feathers are less ruffled.

The larger size and iridescent color add to the appearance of the bird. The flesh has a disagreeable odor; a cat will not eat it.

HABITAT

This species inhabits the borders of streams and rivers exclusively and prefers streams with low, partly inundated banks. The species is abundant along the Abary River and Canje Creek, streams with thick, partly inundated vegetation along the banks. On the other hand the birds are seldom seen along the Essequibo River around Bartica; the banks there are fairly high and in many places rocky. Along the Canje Creek the birds thrive in the bundaree-pimpler (*Drepanocarpus*), an extremely thorny legume growing in the water. The birds may leave the river's border to feed along the open patches of savanna. In Argentina (Territorio de Corrientes and Formosa) the birds were observed in the same ecological habitat.

In the morning the birds fly out from their sleeping place in a thickly foliated tree or shrub to feed before beginning any other activity. The food, consisting of caterpillars, grubs, and other insects and at times fruit or seeds, is found on the ground or sometimes in the trees. The flock may invade a clearing in search of food but seldom strays far from trees or other protection. During the middle of the day the birds usually return to the denser scrub where they remain inactive. In the afternoon they become more active till evening when they collect in the sleeping place again. On both the Canje and Abary Rivers it was noted that the birds always slept on the side which received the last rays of the evening sun. Considering the evident desire of these birds to keep warm and dry it seems likely that this behavior serves that function.

FLOCK BEHAVIOR

Like other members of the subfamily, *C. major* lives in flocks. The number of birds in the flock is most frequently four or six although sometimes an odd number of birds composes a group. For example the three groups most studied intensively (Skeet, Haley, and Benab) consisted of four, four, and six birds, respectively. Each flock is composed of two or three pairs and although during the day the group may spread out over a small area, nevertheless the pair organization of the colony is always apparent. The juvenile and immature birds, identified by the lack of development of the crest of the beak, may remain with the flock for in some cases at least six months. A flock consisting of an odd number of birds frequently contains immatures.

The flock spends the day feeding and resting or taking care of the

young. At all times the birds of the group are within calling distance of one another. Although at times the birds may sit in trees together, they never sit in a row on a limb as *C. ani* habitually does. The birds sleep adjacent to one another but do not touch each other. In British Guiana the birds are extremely wary and inhabit uncultivated and ungrazed districts. Wetmore (1939) reports the same behavior but Beebe (1909) in great contrast to the experience of ornithologists, reports that the birds are tame and follow cattle in British Guiana. When wounded the birds snap the bill vigorously and defend themselves.

It is of particular interest that a group of *C. major* will mingle with a flock of *C. ani*. Frequently a colony of each species came close together and even intermingled. On June 15 two groups were seen to go to sleep near each other. "About sundown a flock of ten or more *C. ani* came in and went to sleep with the usual call. The two species mingled but there was no antagonism." *C. ani* and *C. major*, whose mingling is merely a coincidence, are completely indifferent to one another and show no interspecific social behavior.

TERRITORIAL BEHAVIOR

Each flock of *C. major* lives in a definite area and maintains a territory. This territory is protected by the good will of the neighbors; no severe fighting was ever recorded. The birds know the boundaries and keep to their localities except for short periods, as in this unusual example, on July 15. "The Skeet group continued on to the clearing (within the territory of the Benab group) and one went to the jamon tree. The Benab group (six birds) was there but no fight occurred" even though I forced the two flocks to come together more closely. On August 5, these two groups consolidated after several members of each group had been collected.

Proof that each group has a territory is shown by the behavior of the strangers seen traveling about. Usually one pair but sometimes two pairs may be seen going long distances. Although the travelers may remain in an occupied territory for a short time, eventually they go away even though not driven out. This maintenance of a territory by a group of pairs without any severe fighting is in great contrast to the behavior of *C. ani*.

CALL NOTES

The vocabulary of *C. major* consists of only five notes.

1. The flock call is a loud hoarse croak sounding like *kqua* repeated while the bird is flying from one place to another. This call is purely

social and serves to keep the members informed of the movements of an individual.

2. The alarm call is a harsh rasping note, repeated several times. This note is seldom used, and only when some unknown movement frightens the birds.

3. The most curious call is a gurgling, bubbling *brrrr* resembling the sound of boiling water. When making this sound several birds come together, usually sit on the same branch, gurgle and then stop very abruptly. Although sometimes the whole colony may take part, usually only a few birds perform. The most likely interpretation of this peculiar note is that it is an organization call used to maintain the group and define the territory, analogous to call no. 3 of *C. ani*.

4. The danger note used for hawks and other flying predators consists of three sharp croaks, uttered while the bird flies downward into a thick shrub. On one occasion this note was given when an *Ardea cocoi* flew over.

5. A throaty *kuk* is used at times. The function of this note is not understood but it is perhaps an indication of perplexity (that is, a new situation for the bird), analogous to call no. 9 of *C. ani*.

NESTING

The nests are built in trees or shrubs about three to five meters above the ground or, frequently, above the water. Since the rivers overflow their banks during the rainy season the birds have opportunity to build in trees standing in water. The nest is typically crotophaginine, composed of sticks and lined with leaves. The birds never pick sticks from the ground but always break them from the trees. During incubation the birds continue to bring in green leaves and put them on the nest. The number of eggs laid in the nest depends on the number of females laying. Each female probably lays from five to seven eggs. Young (1929) reports a nest with six eggs. In Formosa, Argentina, I found a nest containing five young. Four adults were nearby. The eggs are large and vary greatly in size. The shell is blue, covered with a thin layer of calcareous material.

DISCUSSION

The territory of *Crotophaga major* is a very clearly defined area of land, although the defense of this territory is not conspicuous. The birds seem to observe the boundary lines strictly and there is thus seldom a need for severe fighting. At no time was any severe fighting or intimidation display observed. Possibly the bubbling note (no. 3) is sufficient to warn off intruders. The fact that *C. major*

will mingle with *C. ani* could be interpreted as indicating that the territory is not defended. However, *C. ani* is a vigorously territorial species in British Guiana as well as in Cuba and would be expected to drive out so similar a species as *C. major*. Hence the mingling of the two species cannot be cited as evidence against the interpretation that *C. major* is territorial, because *C. ani*, a violently territorial species, does not demonstrate its territorialism by driving out *C. major*.

The important point in the social behavior of this species is that each colony is really a group of pairs. At all times the organization of the flock was in pairs, as checked by identification of individuals. Most observations were made at a time when the pairs would be least likely to remain together, that is, after the young are out of the nest and still with the colony. A comparison with the polygamy and promiscuity of *C. ani* indicates the significance of this type of flock organization.

SUMMARY

1. As part of a series of investigations of the social nesting habits of the Crotophaginae, the territorial behavior and nesting habits of *Crotophaga major* were studied in British Guiana during June and July, 1939.

2. The species lives in small flocks, composed of several pairs of adults, which spend the day together and have many social interactions.

3. Each flock maintains a definite territory, although active defense is seldom observed. Wandering birds do not mingle with the flocks.

4. The vocabulary consists of five distinct notes, each having a definite significance.

5. The nest, built of sticks and lined with leaves, contains the eggs laid by several females.

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HOMING INSTINCT OF THE RED-WINGED BLACKBIRD¹

BY REGINALD D. MANWELL

ALTHOUGH it has been known for at least 2500 years that certain species of birds (notably the homing pigeon) possess a strongly developed homing instinct, yet there is still much to learn as to both the mechanism by which this remarkable ability operates and the degree to which it is exhibited in different species. The number of species upon which such experiments have been tried is still small, although it includes such familiar types as the Cowbird, Barn Swallow, House Martin, and Song Sparrow among the land species, and a number of species of waterbirds. Of all the work of this kind, the classic researches of Watson and Lashley on the Noddies and Sooty Terns of the Tortugas and the more recent studies of Rüppell in Germany on the Starling are the most important. The general conclusion to be drawn at present seems to be that while the homing instinct is relatively highly developed in birds, and is probably possessed to at least some degree by all species, yet different species vary greatly in the degree to which they exhibit it. The mechanism by which this ability operates must depend to a large extent on visual recognition of familiar objects when short distances are involved, but for greater distances none of the theories yet proposed offers a satisfactory explanation.

The experiments which are reported below were undertaken to test the degree to which the Red-winged Blackbird (*Agelaius phoeniceus phoeniceus*) possesses the ability to return to the locality where first caught. To do this, the birds, after being caught in a house trap or funnel trap on the University Farm, were taken in covered containers to a number of points at varying distances and directions from Syracuse. Transportation was by automobile. In a number of cases liberation was at night, and in all cases it was rather late in the day. The table below presents a summary of the work done.

The results show clearly that the Red-winged Blackbird possesses a highly developed homing instinct, although it is exhibited less strongly than by certain other common species. As the table shows, some birds returned from each of the places where they were liberated, but in most cases the proportion which returned was not high

¹ From the Department of Zoology, Syracuse University, Syracuse, New York.

TABLE 1
HOMING EXPERIMENTS WITH RED-WINGED BLACKBIRDS*

| Place of release | Direction from trap | Distance (miles) | Date of release | Interval before recapture (days)† | Number of birds released | Number of returns |
|---------------------|---------------------|------------------|-----------------|-----------------------------------|--------------------------|-------------------|
| Syracuse University | N | 2 | various | 2 hours to 28 days | 38 | 18 |
| Fayetteville | E | 9 | 4-17-39 | 4 (1)† | 3 | 2 |
| Tully | S | 20 | 4-21-39 | 3, 12 | 2 | 2 |
| South Bay | NE | 22 | 5-5-39 | 6, 7, 9 | 9 | 3 |
| Cazenovia | SE | 25 | 5-2-39 | 4 | 5 | 1 |
| Montezuma Swamp | W | 30 | 5-3-39 | 5, 13 (2)† | 10 | 4 |
| Winfield | E | 55 | 5-7-39 | 10, 11 | 7 | 2 |
| Watertown | N | 72 | 4-24-39 | 13 | 1 | 1 |
| Rochester | W | 89 | 5-28-39 | (1)† | 2 | 1 |
| Scranton, Penna. | S | 125 | 5-12-39 | (3)† | 10 | 3 |
| Buffalo | W | 140 | 5-20-39 | (2)† | 6 | 2 |
| Aurora | SW | 36 | 5-4-40 | 5, 6, 9 | 10 | 3 |
| Alexandria Bay | N | 90 | 5-12-40 | — | 16 | — |
| Schenectady | E | 114 | 4-27-40 | 12, 16, 21 | 7 | 3 |
| Hadley, Mass. | E | 210 | 4-19-40 | 17, 30 | 7 | 2 |
| | | | | Totals | 133 | 47 |

* All the birds used in these experiments were males.

† The figures in parentheses indicate the number of birds which did not return until the following spring.

and when the date of liberation was late in the spring (after the middle of May) recapture often did not take place until the following year. It is of course true that the birds may have returned earlier without being recaptured. In general we have found that few Red-wings could be captured in our traps after June 1.

Certain other interesting points emerge from the experiments. It is clear that visual memory could have played little part at least in those cases in which the place of release was at a considerable distance from Syracuse, for the cages in which the birds were carried were always covered during transit, and liberation in many cases was at night. It may also be regarded as certain that, except perhaps in the case of points south of Syracuse, the topography of the country was quite unfamiliar to the birds. It will be observed from the table that there was no particular difference in the proportion of returns whether the distances were great or small, or the place

of release in one direction from the city or another. Such differences as appeared were not consistent, but the proportion of birds returning usually approximated one-third. It is true that no birds were recovered of those liberated at Alexandria Bay, but the experience of 1939 suggests that some of these will be recaptured next spring.

It has been observed by others that birds liberated some distance from the point of capture will often wheel about somewhat uncertainly when released, and then head back in the direction from which they came. This was also seen to occur with a number of Red-wings. Even at night, many of the birds when freed would very soon orient themselves toward Syracuse, and fly off in that direction.

In a number of cases the point of release was purposely chosen near bodies of water, or swampy areas (e. g. Montezuma Swamp, Lake Oneida, Cayuga Lake, St. Lawrence River, Connecticut River, Cazenovia Lake), since the Red-wing is fond of such places and nests near them. Home apparently was more attractive, however, for as many birds returned from such points as from any others. It was also observed that certain individuals were much more likely to return and be recaptured than others. This is a fact which has also been observed of other species. But the ability to return could have been only in part due to 'practice', for the first return in a number of cases was from a point a considerable distance from Syracuse. In a number of cases, however, those birds which subsequently came back from considerable distances had previously been released at nearer points, and it might therefore be argued that they had become more or less familiar with local landmarks.

The time which elapsed between the returning of different birds from the same place varied greatly. This might of course have been due to the fact that the birds were not always recaptured soon after they returned. Very often this was presumably the case since those birds which were recaptured after having been released on the University Campus, only about two miles from the traps, were in some instances not recaptured for a number of days. The best recorded time was made by a Red-wing (no. 39-315790) which returned from Schenectady in twelve days, thus making at least ten miles a day, if it is assumed that it was trapped immediately after it came back. In most cases, however, the interval which elapsed before recapture was relatively much greater than this, amounting to almost a year with several birds. In general the results obtained in these experiments parallel quite closely those secured by the writer with Song Sparrows several years ago, except that in the latter case the distances from which the birds returned were much shorter, not exceeding

35 miles. With other species such as the Junco, the White-crowned and the White-throated Sparrow, and the Savannah Sparrow, no returns have been secured at all, although a number of individuals have been released at various distant points as well as locally. It is believed that this may in part be accounted for by the fact that not all these species breed locally, and that they are therefore caught in passage. No doubt they simply resume their migration when released.

In summary, the experiments here reported show that the Red-wing has a strongly developed homing instinct, and that the mechanism by which this operates can hardly be accounted for by any of the theories proposed up to now. Some of the distances seem much too great to permit the retracing of the route by any sort of recollection, while recognition of landmarks along the route would be impossible. Sensitivity to magnetic variations cannot of course be ruled out, but no one has ever produced any real evidence in support of this theory. Birds which were liberated (often the same birds were used in several experiments) at distances of as much as 210 miles returned to the point of original capture in Syracuse, whether the time of liberation was before or after dark, and equally well apparently from any point of the compass. Speed of travel, as far as could be determined from the length of time between liberation and recapture, was rather slow. Certain birds exhibited the homing instinct much more strongly than others, and the proportion of birds recaptured after any given liberation did not exceed 50 per cent, and was generally not over 33 per cent. Unlike the results obtained in some other work of this kind, this proportion was not appreciably less in the case of birds released at greater distances, but such differences might have been observed had the numbers of birds been greater and the distances still further increased.

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SIZE OF BIRD FLOCKS IN WINTER

BY LEONARD WING

IN the forty years during which the 'Bird-lore' Christmas censuses (1900-1939) have been taken, many observers have reported the number of individuals observed in flocks of various species. No concerted effort has been made to gather these data, but the reporting of flocks has been only additional data as far as the census-takers were concerned. Naturally, the number of flocks reported has varied from year to year. Over the entire forty-year period 2,514 flocks have been reported for 104 species of birds. The individuals contained in these flocks number 113,116, an average of 44.99 per flock. The number of flocks reported for each species varies from one to 1,101, the latter figure being the total for the Bob-white. The flocks have been reported both singly and in groups. Thus one observer might report two coveys containing thirty Bob-white while another might report two coveys containing sixteen and fourteen birds, respectively. Reported singly, there were 803 flocks containing a total of 34,964 individuals. The number of species with singly-reported flocks totalled 101.

There are two possible reasons for winter aggregations of birds: the birds may *associate* together because of a gregarious urge, or they may *congregate* for reasons of habitat. The association of individuals probably constitutes a true flock since the birds join together voluntarily. The congregation probably should not be considered a true flock since the birds are thrown together only because the environment which they individually seek is limited.

A number of apparently very large flocks have been reported. They range in size from 500 to 25,000 individuals, the latter at a Starling roost. In the case of a few of these, the reports indicate that they are not true flocks but rather *aggregations* of smaller flocks. Where it has been possible to determine that such numbers were aggregations of smaller flocks, the data have been omitted from the tabulations used in this paper. In cases where the status could not be determined, they have been assumed to be true flocks.

Another matter of some significance is the minimum number of individuals that make up a flock. Should a pair of nuthatches be considered a flock? It is probable that two nuthatches associated together in winter constitute a true flock. They are not *mated* but are *associated* because of gregariousness, rather than because of environmental compulsion. Nuthatches and other associated birds call

back and forth, indicating that they are aware of and interested in others of their kind. The same may be said of true flocks of other species such as the Bob-white. On the other hand, the Ring-necked Pheasant may be cited as an example of birds that are chiefly solitary, and which rarely congregate except when thrown together by scarcity of wintering habitats. We can probably interpret a true flock as two or more birds associated together because of an internal gregarious urge rather than congregated together because of external environmental pressure.

The flocks of each species reported have been separated into three groups: migratory species, semi-migratory species, and resident species. Designation of species as 'migratory', 'semi-migratory', or 'resident' presents somewhat of a problem. The classifications of migratory and resident are quite clear-cut, but what constitutes semi-migratory species is not so clear. Semi-migratory species are here considered to be those that exhibit a tendency to migrate in parts of the range and to be resident in other parts of the range in considerable numbers. Naturally, decisions have had to be somewhat arbitrary in a number of cases. It is believed, however, that these designations are substantially sound.

In a summation of the data for those species for which more than ten flocks have been reported, the Grackle (Purple, Florida, and Bronzed) with 433.87 individuals has the largest average flock size of all the species for which data for ten or more flocks are available. Next is the Snow Bunting with an average of 310.55. At the other end of the scale is the White-breasted Nuthatch with an average of 2.29 individuals.

The weight of the average flock¹ puts the Canada Goose at the head of the list with 180,000 grams. The Golden-crowned Kinglet with an average of 35 grams per flock is at the bottom of the list. The flocks of the migratory birds are heavier than those of the non-migratory birds. Heavier flocks are found in the relatively omnivorous species than in the insect-eating or granivorous species. The weight of the flock also varies with the cruising radius of the species. With the exception of the pheasant (which probably does not have true flocks), the Hungarian Partridge, and the Bob-white, no species of low daily cruising radius averages more than 1,000 grams per flock. Birds having flocks averaging in excess of 2,500 grams (excepting pheasant and Hungarian Partridge) have daily cruising radii of five miles or more. The relationship between the

¹ The weight of the average flock has been estimated by multiplying the average weight of the individual by the number of birds in the average flock.

weight of the flocks and the cruising radii reflects the greater mobility needed for flocks requiring larger quantities of food. It seems probable that the greater mobility makes possible the larger flocks.

In order to test the probability that mobility and habit differences are general, the data have been recombined into natural groupings in Table 1. While the data for several groups are not so plentiful

TABLE 1
AVERAGE SIZE OF FLOCKS BY GROUPS

| | <i>Number of flocks</i> | <i>Number of individuals</i> | <i>Average size of flock</i> |
|--|---------------------------------|--------------------------------------|--------------------------------------|
| Dabbling Ducks | 22 | 870 | 29.55 |
| Diving Ducks | 33 | 13,724 | 415.88 |
| Fish Ducks | 9 | 242 | 26.88 |
| All ducks (including 'Unidentified') | 68 | 19,598 | 288.21 |
| Galliformes | 1,197 | 14,174 | 11.84 |
| Galliformes other than Bob-white | 96 | 928 | 9.67 |
| Shorebirds | 19 | 635 | 33.42 |
| Passeriformes | 1,145 | 75,635 | 66.05 |
| Migratory Passeriformes | 643 | 68,482 | 106.50 |
| Semi-migratory Passeriformes | 238 | 4,832 | 20.30 |
| Resident Passeriformes | 264 | 2,321 | 9.79 |
| Fringillidae | 464 | 18,602 | 40.09 |
| Migratory Fringillidae | 326 | 16,062 | 49.27 |
| Semi-migratory Fringillidae | 99 | 2,133 | 21.55 |
| Resident Fringillidae | 39 | 407 | 10.44 |
| Migratory birds | 795 | 91,374 | 114.94 |
| Migratory flocks (averaging under 100 birds each) | 548 | 19,771 | 36.08 |
| Migratory flocks (averaging more than 100 birds each) | 247 | 71,603 | 289.89 |
| Semi-migratory birds | 252 | 5,140 | 20.40 |
| Resident birds | 1,467 | 16,602 | 11.32 |
| Resident birds other than Galliformes | 270 | 2,428 | 8.99 |
| All flocks (104 species) | 2,514 | 113,116 | 44.99 |

as one would wish, certain relationships are indicated. The diving ducks have the largest average flock size of all, a corollary of their cruising radius and available food. It is probable that a better knowledge of flock composition making up aggregations will materially reduce the apparent average size of the flock.

The tendency of the more sedentary birds to associate in flocks smaller than those of migratory birds is shown by the summations

for migratory, semi-migratory, and resident species. The 795 flocks of migratory species average 114.94 birds while the 1,467 flocks of resident species average but 11.32. Removal of the 1,197 flocks of gallinaceous birds leaves 270 flocks of resident birds averaging 8.99 individuals. It is obvious that the difference is a consistent one, not traceable to the preponderance of gallinaceous flocks. The semi-migratory flocks average 20.40 individuals which is less than a sixth of the size of the migratory flocks. On the other hand, the resident flocks average less than half the size of semi-migratory flocks and but a tenth of the size of the migratory flocks.

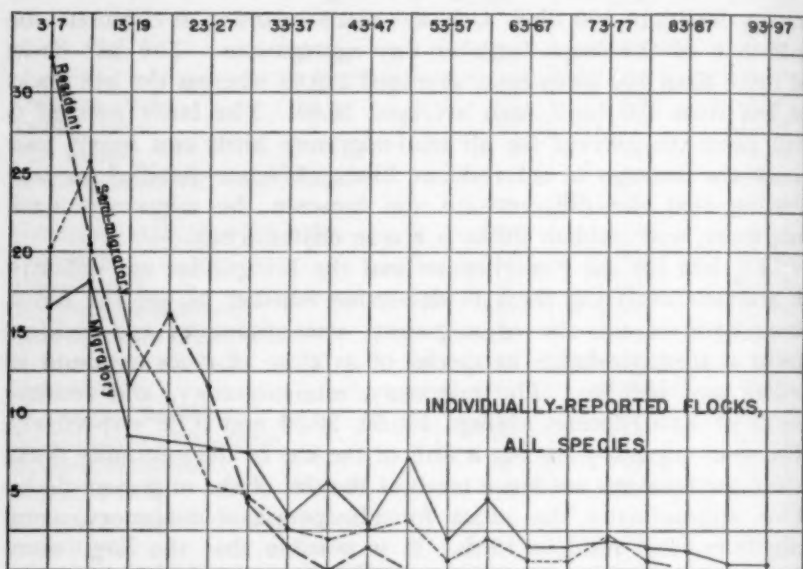
A separate summation for those having more than, and for those having less than 100 birds each was made in order to eliminate the influence of the huge flocks or any aggregations. The 247 flocks of more than 100 birds each, averaged 289.89 whereas the 548 flocks of less than 100 birds each averaged 36.08. The latter average is still twice the average for all semi-migratory birds and nearly four times the average of all resident birds. We are justified in concluding that the difference in size between the migratory, semi-migratory, and resident flocks is a true characteristic.

The data for the Passeriformes and the Fringillidae are sufficient to warrant analyzing them to determine whether or not the differences between the size of migratory, semi-migratory, and resident flocks is distinguishable in species of as close affinities as found in orders and families. The migratory, semi-migratory, and resident flocks of Passeriformes average 106.50, 20.30 and 9.79, respectively. The semi-migratory are but a fifth of the size of the migratory flocks while the residents are but a tenth of the size of the migratory flocks. This approximates the ratios for all species of migratory, semi-migratory, and resident birds. It is possible that the large numbers of Passeriformes flocks are responsible for the ratios for all species. However, a check of the non-Passeriformes flocks indicates that this is not the case.

The migratory Fringillidae average 49.27 birds, while the semi-migratory and resident species average 21.55 and 10.44, respectively. The difference between the semi-migratory and the resident is substantially the same as before, but the size of the migratory flocks has been reduced by a half, likewise reducing the ratios proportionately. It is clear from these breakdowns that the relationship between the size of migratory, semi-migratory, and resident flocks is true.

Flocks reported singly total 803 for 101 species. In order to determine the range between the respective maximum and minimum average flocks for the three groups, the largest and the smallest flock

for each species have been combined separately. The average of the respective largest flocks is 346.18 for the 101 species while the average of the smallest is 15.62. The occurrence of a larger average flock in the migratory than in either the semi-migratory or the resident species is found in both the average maximum and the average minimum flocks. The difference between the average minimum flock and the average maximum flock is approximately thirty times in the migratory group but only three times in the semi-migratory and resident groups. It is clear that a greater range in the size of flocks occurs in migratory species than in either semi-migratory or



TEXT-FIG. 1.—Frequency grouping of individually reported flocks.

resident species, a fact to be noted in the data of Table 1. The flock is a more consistent unit in the more sedentary birds than in the more migratory.

A frequency grouping of the flocks reported individually shows some interesting concentrations. The flocks have been grouped by fives between three and ninety-seven birds per flock. Only one flock smaller than three has been reported so that three is taken as the starting point. There are a number of scattered reports of flocks larger than ninety-seven, but these reports are not necessary to a frequency distribution grouped by fives. The data have been graphed in Text-figure 1. From the graph and the tabulation it

appears that the flocks of resident birds concentrate in the low range while the semi-migratory and migratory species have flocks somewhat larger in size. Fifty per cent of the resident flocks number 8-12 individuals or less while fifty per cent of the semi-migratory flocks are under 13-17 individuals. The flocks of the migratory birds do not total fifty per cent until the 18-22 grouping is reached. Similarly, we find that the flocks reach seventy-five per cent at the 18-22, 23-27, and 38-42 groupings, respectively. The flocks of resident birds drop off at the fifty mark while the semi-migratory groups end at eighty-five with but few scattered flocks beyond.

The average flock-size for the Bob-white, based upon 1,101 flocks is 12.03 birds. There are data for 96 gallinaceous flocks other than Bob-white and these average 9.67 birds per flock. Inasmuch as the Bob-white has the lowest cruising radius of the gregarious gallinaceous birds reported, it seems likely that the size of the flocks is related inversely to the cruising distance as well as to the size of the individual birds.

There were 188 Bob-white flocks reported singly. A frequency distribution shows that the majority of Bob-white coveys range between 7 and 19 individuals. The few which are larger are probably combined coveys which have not yet re-formed as a result of the 'fall shuffle.' The size of the coveys varies from region to region. In a summary of the regional distribution of the flocks, the largest coveys are found in the North-central region, averaging 12.54. The smallest are found in the Gulf States, averaging 10.54. They differ in size by two birds. The second largest flocks are found in the Northeastern region where they average about one bird smaller than the coveys of the North-central region. Likewise the coveys of the Central region average slightly less than coveys of the Northeastern region. These size differences parallel the differences in weather and seem to reflect the greater need for protection from cold which is provided by the larger roosting coveys inhabiting the coldest regions.

The temperature difference for the respective sections becomes important for Bob-white as winter progresses. Due to the continental influence on temperature distribution, during the early fall temperatures approach uniformity for a brief period in the four regions. The differences between the interior of the continent and the coast, and between the North and the South become pronounced as winter advances. By Christmas time the differences are decidedly pronounced, even more pronounced (especially between the North-central and the Northeastern regions) than the average monthly temperature indicates.

SUMMARY

During the interval 1900-1939 inclusive, 2,514 flocks containing 113,116 individuals have been reported for 104 species of birds. The number of singly-reported flocks is 803 containing 34,964 individuals.

The species have been grouped as migratory, semi-migratory, and resident. Migratory species have larger flocks than semi-migratory or resident species. Semi-migratory species have larger flocks than resident species.

Grackles have the largest flocks (averaging 433.87) while the White-breasted Nuthatch has the smallest (averaging 2.29).

The Canada Goose has the highest average weight per flock (180,000 grams), while the Golden-crowned Kinglet has the lowest (35 grams). Migratory species have flocks of greater average weight than non-migratory species.

Heavier flocks are found in relatively omnivorous species than in insect-eating or granivorous species.

With the exception of the Bob-white, no species of low daily cruising radius has true flocks averaging more than 1,000 grams in weight.

With the exception of the Hungarian Partridge, true flocks averaging more than 2,500 grams in weight are found only in species having daily cruising radii in excess of five miles.

The data for the Bob-white indicate that the size of its covey is correlated with temperature, the covey averaging the largest in the North-central States and smallest in the Gulf States.

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ENEMY RECOGNITION BY THE SONG SPARROW

BY MARGARET M. NICE AND JOOST TER PELKWYK

Plate 8

IN connection with the study of inborn and learned behavior in the Song Sparrow (*Melospiza melodia*) an attempt was made to experiment on fear reactions in hand-raised birds, particularly on the question as to what it is that constitutes an 'enemy' to these birds. The Song Sparrow is a favorable subject for tests because the number of notes, either of 'alarm' or 'fear,' varies with the degree of excitement. In this we have an objective criterion of the degree of fear. Hand-raised Goldfinches (*Spinus tristis*), on the other hand, were either indifferent when tested, or flew wildly about the cage; it was easy to see what frightened them, but impossible to make a comparative study of the effectiveness of different stimuli.

As stimuli in our tests we used live animals, mounted birds, and cardboard models. For the loan of the mounted birds we wish to thank Mr. E. R. Blake and Mr. Rudyerd Boulton of the Field Museum of Natural History, Mr. Charles Rogers of Princeton University, and Mr. Earl Wright of the Chicago Academy of Sciences.

OBSERVATIONS BY OTHERS

Several experimental approaches have recently been made to an analysis of the predator-prey relation from the standpoint of the predator (Tinbergen, 1940); but often the assumption seems to have been that the prey is passive. We know, however, that the prey has its special methods of defense, such as threatening, flight, hiding, or making use of protective coloration. Observations and experiments on enemy recognition are scattered. Bolles (1890) carried a captive Barred Owl (*Strix varia*) into the woods and recorded the reactions of the birds toward it; the majority of the birds "scolded" it, doing so more vigorously in summer than in winter. Thorndike (1899) experimented on instinctive reactions of young chicks, finding no instinctive fear of cats. "There develops in the first month a general fear of novel objects in motion." A tame Carrion Crow (*Corvus corone*) and Jackdaw (*Corvus monedula*) were noted by Hertz (1926) to react to every new object with fear, but as soon as the object proved

to be harmless, the fear changed into curiosity and after that to aggressiveness. Various creatures were put into a cage with a "hungry chicken snake" by Kellogg (1931); fear was shown by wild adult English Sparrows (*Passer domesticus*), but none by an adult Canary, nor by chicks less than a week old. The fear of snakes is often assumed to be inborn. Experiments by Antonius (1939) show, however, that the well-known snake-fear in apes and monkeys is probably not inborn, but learned from companions. No inborn fear of snakes was found by Rand (1937) in two hand-raised Blue Jays (*Cyanocitta cristata*); a dog was at first ignored by the birds, but after one was 38 days old, it flew up out of the dog's reach. Brückner (1933) states that very young chicks were afraid only of loud noises and of the loss of balance. Toward rabbits they behaved indifferently at first, but at the age of three weeks they reacted with distinct fear.

There are a number of experiments using birds of prey or models of the same. Lorenz (1935: 356) mentions the violent reaction of a hand-raised *Passer domesticus* to the first owl the bird ever saw; he states that the Magpie (*Pica pica*) instinctively recognizes a predatory animal, but that the Jackdaw, that lives in flocks, does not. A mounted owl (*Asio otus*) and hawk (*Accipiter*) provoked fear in a tame Hooded Crow (*Corvus cornix*) and hand-raised Jackdaws (Strausz, 1938). Plaster models of the heads of these birds, painted or white, also provoked fear when the head looked in the direction of the Crow or Jackdaw. The birds were much less disturbed when the mounts and models had their backs turned. A mounted Jackdaw aroused curiosity or was ignored. Although the effect of the mounted owl and hawk was very great at first, after repeated experiments or if the objects were left for some time in the cage, the birds gradually became indifferent. Krätzig (1939) found in young of the Hazel Hen (*Tetrastes bonasia rupestris*) no signs of fear before the age of ten days; after that they showed marked fear reactions to dogs and hawks. Goethe (1937), Tinbergen (1939), Lorenz (1939) and Krätzig (1940) describe experiments in which cardboard models of various shapes were moved through the air along wires. Goethe noted a specific reaction in young Blackcocks (*Lyrurus tetrix*) to models of birds of prey; there was a sexual differentiation in chicks as young as twenty days, the females seeking cover, the males assuming a defensive attitude. The experiments of Lorenz and Tinbergen showed that young Grey Geese (*Anser anser*) react from about the eighth week on; the form of the model was not as important with these birds and with ducklings as with young Turkeys (*Meleagris*

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FIG. 1.—Attitudes of Song Sparrow in alarm, fear and fright. From left to right (upper row): 1, unalarmed; 2, alert; 3, turning head to look; 4, 5, alarm (wings and tail flipped); 6, strong alarm; 7, fear; 8, fright (panting).

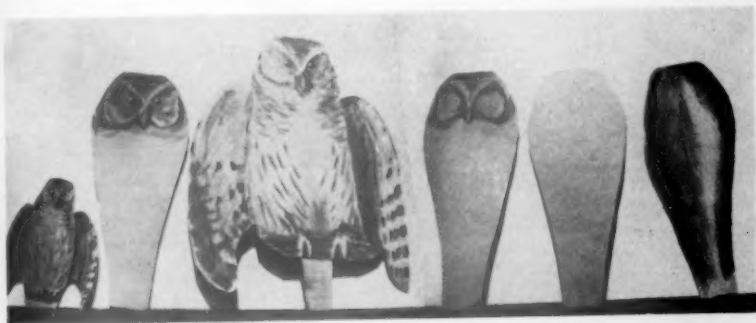


FIG. 2.—Cardboard models of owls. From left to right: 1, model at half scale; 2, 'head' model; 3, 'best' model; 4, 'head' model without eyes; 5, 'outline' of 'head' model; 6, model with shading on the sides.

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gallopavo) and Krätzig's Rock Ptarmigans (*Lagopus mutus*). With both these species a model with a short neck and long tail (*Accipiter*) provoked strong fear reactions, but the same model was largely ignored when pulled overhead with the long end forward (goose). Young hand-raised ptarmigans were frightened by a live dog, but paid no attention to models of mammals. Kelso (1940) found that young Screech Owls (*Otus asio*) showed fear at the sight of the skin of a Crow (*Corvus brachyrhynchos*) when it was moved.

In a letter Mrs. Amelia Laskey describes some observations made on a hand-raised Mockingbird (*Mimus polyglottos*): "Jan. 11, he fights everything that comes his way including the dog, his shadow, his reflection, and other birds that I hold near him excepting a dead Screech Owl. To that he gives a pronounced fear reaction, flying in frightened, fluttering manner as far back in his cage as possible when he sees the owl. He attacked a Sparrow Hawk through the wire." On June 11, she wrote: "When I had the Saw-whet Owl (*Cryptoglaux acadica*), he showed fear of it. One evening the owl was free in the room and flew to a perch above the Mockingbird's cage. The Mockingbird craned his neck repeatedly to watch the owl who was four feet above his cage, giving sharp staccato *chi-chick* calls repeatedly. The owl bent its head a number of times to look at the Mockingbird, but showed no special interest even when the room lights were dimmed. After the owl was taken out of the room all lights were switched off. In about ten minutes the Mockingbird began to give the staccato calls again. I went quickly to the room, turned on bright lights and saw the Mockingbird crane his neck and turn his head sideways looking toward the spot where the owl had perched."

A curious phenomenon has been mentioned by the Heinroths (1924-32), namely, that some birds are afraid of colors, some of blue, others of red. Among the former they cite one of a brood of five Red-backed Shrikes (*Lanius collurio*), three of a brood of five Gray Wagtails (*Motacilla flava*), a Jackdaw, a Yellowhammer (*Emberiza citrinella*) and a Cockatoo. Tree Pipits (*Anthus trivialis*) were afraid of red. A pair of Goldfinches, taken from the nest at the age of two days by Wm. E. Schantz and later brought to Chicago, were afraid of a dark-blue box top, flying wildly in the cage whenever it was shown. They feared some other blue objects, but not miscellaneous objects of other colors. Another pair raised by Mr. Schantz, showed fear only to black paper. In our experiments with Song Sparrows we did not observe a fear for any color.

BEHAVIOR OF THE SONG SPARROW WHEN ALARMED

Three chief stages of fear may be distinguished in the Song Sparrow:

| Stage | Note | Postures |
|----------|--------------------|--|
| 'Alarm' | <i>tchunk</i> | Crest raised; tail raised and flipped; wings flipped; restless change of location. |
| 'Fear' | <i>tik</i> | Feathers compressed; neck elongated; body crouched. |
| 'Fright' | <i>tik-tik-tik</i> | Flies and hides; flutters in attempt to escape; pants with open bill. |

These categories show 'alarm,' 'fear' and 'fright' in their extreme form; in milder cases some of the characteristics are not shown. In the first stage all characteristics except the raised crest may be displayed separately in situations that are obviously not concerned with alarm. The note *tchunk* is the 'ordinary' note of the male Song Sparrow on his territory, and is seldom heard from the female except in the nesting season; it is typically given by her directly after she has left the nest during incubation and more vigorously in connection with the approach of an enemy to the nest. It often seems to have an element of 'protest' in it. Sometimes it seems to be given by the male as a matter of 'self-assertion.' (With the hand-raised males it is often given while bathing; here it might be interpreted as vocal self-assertion while temporarily hampered by wet feathers.) It appears to be analogous to the 'rain-call' of the Chaffinch (*Fringilla coelebs*), as described by Sick (1939), which often expresses discomfort or anxiety, and also appears to be a special expression of territory advertising.

Wing- and tail-flipping may accompany 'pleasurable' excitement, as when the pair hunt for a nesting site. Raising the crest nearly always appears to express some alarm or apprehension. It has been characteristic of the underling male with the hand-raised birds.

The rhythm with which the notes are given and the species of note vary with the degree of excitement. To illustrate this, three examples will be given with wild Song Sparrows in Massachusetts in 1940.

June 12: the observer in searching for a nest which contained newly hatched young came within a few meters of it; the female gave 48 *tchunks* and five *tiks* in one minute. The observer left, walked 50 meters and hid; the bird then gave 32 *tchunks* in a minute. Two days later when the nest was visited, the female gave 56 *tchunks* in a minute; as soon as the observer was out of sight she gave 35 in a minute.

July 11: one parent was 'scolding' a cat, 8 meters from the nest containing 6-7-day young; at first the cat was looking at the Song Sparrow, later it turned its back and chewed a weed. In three consecutive minutes the bird gave 51 notes a minute: in the first minute 1 *tchunk* and 50 *tiks*, in the next 15 *tchunks* and 36 *tiks*, in the third, 47 *tchunks* and four *tiks*.

June 30: a mounted Barred Owl was fixed near a tangle in which were a Song Sparrow and young that had recently left the nest. The adult gave 64 *tiks* in the first minute, 63 in the next and 65 in the third.

The first bird showed alarm: strong alarm with 56 *tchunks* a minute and moderate alarm with 32-35 a minute. The second bird showed fear first, later alarm: fear with approximately 51 *tiks* a minute, and alarm with approximately 51 *tchunks*. The third bird showed fear with 64 *tiks* a minute.

REACTIONS OF SONG SPARROWS IN NATURE TO ENEMIES

In a letter Richard Pough informs us that the chief enemies of Song Sparrows among the hawks and owls are, in order of importance: Cooper's and Sharp-shinned Hawks (*Accipiter cooperi* and *velox*), Long-eared and Screech Owls (*Asio wilsonianus* and *Otus asio*), Pigeon and Sparrow Hawks (*Falco columbarius* and *sparverius*), Marsh Hawk (*Circus hudsonius*) and Red-tailed Hawk (*Buteo borealis*). Sherman (1911) found that Juncos (*Junco hyemalis*) and Song Sparrows were the most frequent victims of a nesting pair of Screech Owls which she studied in Iowa.

Song Sparrows were studied for nine years in the field on Interpont, Columbus, Ohio (Nice, 1937); the enemies most frequently recognized by the birds were the cat and the Cowbird (*Molothrus ater*). Other enemies that might have taken toll of the Song Sparrows were: snakes, dogs, rats, opossums, weasels, skunks, red squirrels, chipmunks, Pheasant (*Phasianus colchicus torquatus*), Bronzed Grackle (*Quiscalus quiscula aeneus*), Blue Jay, Accipiters, Sparrow Hawk, Screech Owls. Reactions of the birds to a number of enemies were observed.

Snakes.—A large garter snake lying 60 cm. below 1M's nest with newly hatched young was treated with curiosity by 1M; he hopped around it and gave it a peck. The following year 1M's mate on five occasions was seen to attack small snakes in the vicinity of her nest containing young; sometimes she was silent, but twice she gave sputtering notes. 1M was present in one instance, but remained indifferent.

Rabbits.—Cottontail rabbits were consistently ignored, except that once a female gave the threat note to a young rabbit sitting near her nest containing eggs.

Cats.—Cats were consistently greeted with *tchunks* given at a rapid rate (strong alarm), the *tchunks* being taken up by all the Song Sparrows in the neighborhood. Once parents with young ten days out of the nest gave *tik-tik-tik* at a cat.

Dogs.—Dogs were ignored unless they approached near the nest, when *tchunk* was given. On several occasions dogs broke up nests, killing the female and (or) young.

People.—Usually people are greeted with *tchunk* when they come near the nest. When the young are about ready to leave the nest and shortly afterward, the parents, especially the female, are apt to use *tik* as well as *tchunk* and also a variety of miscellaneous notes, that are only used in connection with disturbance over young. Occasionally *tchunk* is used in the winter when a Song Sparrow has been startled by the sudden appearance of a person. *Tik-tik-tik* has been recorded from Song Sparrows in relation to people when the birds are in a heightened state of excitement over mate or young. It was given by a male a few days after being joined by a mate, and by 4M when both his first and his second mate in 1935 were trapped and the bander came to get them. It was given by 5M and 4M with young two days out of the nest, and by the latter when one of his young, a week out of the nest, came near the observer. It was also given by a female when a person approached her well-grown Cowbird foster-child.

Cowbird.—During the nesting season Song Sparrows react to the presence of the female Cowbird on their territories with emphatic *tchunk*-ing. If the Cowbird comes near the nest, the pair attack her. One pair were seen doing this in the presence of one of their young that was six weeks old. Records of alarm over the presence of Cowbirds range from March 30 to July 14. A male that was known to be a juvenile bird by the character of his singing reacted strongly from April 18 on to the visits of courting Cowbirds to the chief tree in his territory. Ovenbirds (*Seiurus aurocapillus*), although heavily parasitized by the Cowbird, do not recognize this bird as an enemy (Hann, 1937).

Bronzed Grackle.—Twice individuals of this species were observed near Song Sparrow nests, the parents of which were reacting with strong alarm.

Robin.—On one occasion Song Sparrows were *tchunk*-ing at a Robin (*Turdus migratorius*) near their nest. Smaller birds in such situations were driven off.

Sparrow Hawk.—Once (March 15) the Song Sparrows gave *tik-tik-tik* when a pair of *Falco sparverius* appeared; on another occasion (November 2) they gave *tchunks*; twice (February and October) they fell silent, and finally, when one of these falcons flew at two fighting males, they hid. In the vicinity of the falcon's nest the Song Sparrows were indifferent and this was also true in general throughout the nesting season. Three times a falcon was seen trying to catch a small bird without success, but twice individuals were seen eating small birds.

Marsh Hawk.—All Song Sparrows stopped singing and many said *tik-tik-tik* when a large female flew over slowly on March 1.

Sharp-shinned Hawk.—The Song Sparrows gave *tik-tik-tik*, hid, and remained 'frozen' for some minutes.

Red-shouldered Hawk.—On August 17, 1940, in Pelham, Massachusetts, a *Buteo lineatus* was seen to fly over a swamp; a few minutes later the observer reached this locality and heard loud *tchunks* given rapidly by a male Song Sparrow seated on top of an alder. In four different minutes from 12.25 to 12.36 he gave the following number of *tchunks* a minute: 108, 92, 76, 64. His mate in the meantime gave 27 *tchunks* and five *tiks* in one minute, 24 *tchunks* in another. The observer left the swamp and at 12.40 the male gave 18 *tchunks* in one minute. The pair had young recently out of the nest; their excitement was undoubtedly due partly to the very recent sight of the hawk and partly to the presence of the observer. The male was unusual in giving *tchunks* at such a very rapid rate instead of using *tiks*; the next highest record we have for number of *tchunks* per minute is 70 from Y.

Owls.—There was no opportunity to observe the reaction of wild Song Sparrows to these birds, except the test already mentioned with the mounted Barred Owl.

Reaction of small birds to owls, cats, and some other enemies has a biological function; the 'alarm' notes are understood by birds of many other species; a number gather and, following the enemy with loud cries, make it impossible for it to come unheralded upon its prey.

EXPERIMENTS WITH ADULT HAND-RAISED BIRDS

The subjects.—Most of the experiments were done with the male Y, but some results were obtained on the male D and the female J before their deaths by accident in March 1940. Y was taken from the nest in Pelham, Massachusetts, on August 1, 1938, at the age of five days. D was taken from the nest in Augusta, Michigan, on June

20, 1939, at the age of six days. J was taken from the nest when about eight days old in Columbus, Ohio, August 12, 1939, by Mr. W. E. Schantz and brought to Chicago in November. The males had the liberty of the study until December 1939, when it became necessary because of territorial fighting to keep one or the other caged. J was kept in a large cage 60 by 90 by 120 cm. in size, later used for Y in the experiments carried out in May 1940. D and Y were always experimented on separately, but this was not true with J. She was present when Y was tested with the mounted Barred Owl on February

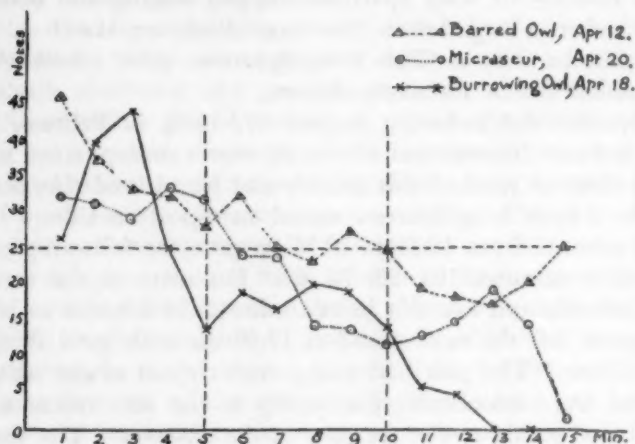


CHART 1.—Diagram showing the number of *tchunks* per minute given by Y to three mounted birds: Barred Owl, Burrowing Owl, falcon (*Micrastur*), each shown for 15 minutes at about four meters from the cage. This illustrates the decrease in the reaction during an experiment.

1 and 25, when he was tested with the teddy-bear on February 25, and when D was shown the teddy-bear February 9.

Experiments.—Five series of tests were carried out:

1. Live animals brought within 1.5 meters from the cage or even released into the cage: snakes, rat, rabbits, dogs, cats.
2. Moving models: mounted Barred Owl with moving wings, flying models outside the window, models brought suddenly to the cage.
3. Series of objects, mostly mounted birds, each shown for 15 minutes on a victrola about four meters from the cage: Barred Owl, hornbill, Ruffed Grouse, Burrowing Owl, falcon, kite; also a teddy-bear and a large pitcher (Chart 1).
4. Series of objects, mostly cardboard, shown on the victrola with white cardboard as a background; each shown for three minutes with

five-minute intervals between tests. The models (Plate 8, fig. 2) were largely of owls, but included a duck, quail, hawks, and a shorebird. In each experiment one object was used as a standard, and reshown at intervals to test the level of the bird's reaction. The sequence of the models was such that strong and weak stimuli alternated, so that every test showed as much as possible the reaction to that particular model (Charts 2 and 3).

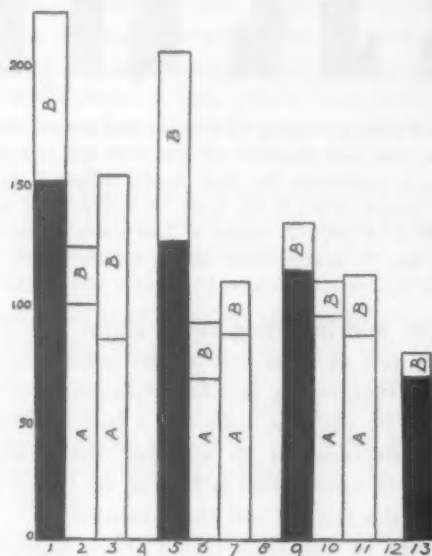


CHART 2.—Diagram showing the number of *tchunks* during the three-minute tests (A) and five-minute intervals (B) on May 19. The same model ('head' model) was shown after every three tests, giving a standard of reactionability during the experiment. 1, 5, 9, 13, 'head' model (Plate 8, fig. 2, no. 2); 2, duck; 3, kite; 4, 8, 12, 'outline' of 'head' model (Plate 8, fig. 2, no. 5); 6, shorebird; 7, Duck Hawk; 10, model with shading on the sides (Plate 8, fig. 2, no. 6); 11, quail.

5. Mounted Barred Owl on the piano in the front room. Also the same situation without the owl.

The series of tests falls into two groups: the two first are experiments with moving enemies, the three last with stationary enemies.

In interpreting the reactions of our subjects we use the criteria for 'fear' and 'fright' mentioned previously. As to 'alarm,' in general we found the rate of the notes fell into three fairly distinct classes: 10-15 a minute (weak alarm), 25-30 a minute (moderate alarm), and about 50 a minute (strong alarm). In three minutes the number of *tchunks* in weak alarm ranged from about 40-65, in moderate

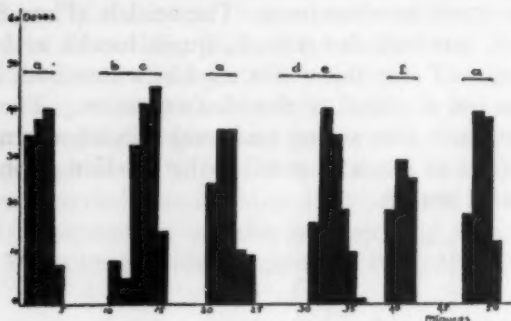


CHART 3.—Diagram showing number of *tchunks* per minute during one series of tests (May 17). The time and duration of the tests are represented by lines at the top of the chart. *a*, represents the 'best' model (Plate 8, fig. 2, no. 3); *b*, the 'outline' of the 'head' model (Plate 8, fig. 2, no. 5); *c*, the 'head' model (Plate 8, fig. 2, no. 2); *d*, the 'outline' of the owl model at half scale; *e*, the owl model at half scale (Plate 8, fig. 2, no. 1); *f*, the 'head' model upside down.

alarm about 80–120, and in strong alarm about 130–200. The three-minute records are not as clear cut as the one-minute ones, since Y would seldom start *tchunk*-ing the first moment the experiment began, and sometimes he did not start for a full half-minute or more; in these cases the decision as to whether the reaction should be classed as moderate or strong alarm had to be based on the number of *tchunks* given in the second and third minutes.

Since the majority of the tests lasted three minutes, we use this period as our standard in the following report and unless otherwise stated the number of *tchunks* mentioned was that given in three minutes.

Moving Enemies

In general the reactions are stronger to moving than to stationary objects. The birds had never before had experience with the first three animals shown in the tests, so we conclude that the reactions are partly inborn.

Snake.—Two garter snakes (*Thamnophis sirtalis*) 30 and 70 cm. in length were shown within one-meter distance. Both moved rapidly and the smaller one was allowed in the cage. Y reacted by craning his neck, but showed no signs of alarm.

Rat.—Two active white rats, one half grown, the other fully grown, were brought to Y's cage and the smaller one allowed in the cage. Y reacted by elongating himself, the characteristic attitude of curiosity, but showed no alarm.

Rabbit.—A large black-and-white rabbit was placed next Y's cage, where it hopped about. Y flew back and forth high in the cage, panting with open bill (fright), but gave no note. The rabbit was removed and shown again in the same place after eight minutes; at this time it was quiet. Y gave 107 *tchunks* in three minutes (moderate alarm).

Dog.—On April 1 a medium-sized, active, white dog was brought within a meter of the cage; Y flew about as high as he could (fright), but gave no note, until two minutes after the dog was removed, when he gave 25 *tchunks* in one minute. On September 18, a young chow was brought to the cage; Y flew wildly back and forth; the dog was removed and Y gave a few *tiks*. In a day or two Y became indifferent to the puppy.

Cat.—No reaction was ever given to cats seen out the window. On September 17, 1939, three small kittens were brought in and placed near the cage; Y reacted with moderate alarm. On April 15, 1940, a medium-sized black cat was held one and a half meters from the cage, where it moved somewhat, purred and coughed. Y reacted by raising his crest and flipping his tail and gave the following number of *tchunks* during the five-minute test: 10, 20, 12, 0, 0 (weak alarm). During the summer Y was cared for by Mrs. Dorothea Ewers who kept him on an outdoor screened porch; on several occasions Mrs. Ewers heard him giving *tik tik*, whereupon she went out and chased a cat from the railing.

On September 23, a small gray-striped kitten was placed next his cage. Y was disturbed, flying back and forth high in the cage, but gave only six *tchunks*. To a small white kitten he behaved in a similar manner, but gave 72 *tchunks* and three *tiks* in three minutes.

Birds outside the window.—Sometimes the Song Sparrows show fright reactions, giving *tik-tik-tik* and hiding, apparently stimulated by the sight of some bird in the sky. On May 27, a Starling (*Sturnus vulgaris*) flew rapidly by at 10 to 15 meters distance; Y gave the *tik-tik-tik* note, flew to the side of the cage and hid (fright). On September 27 a Blue Jay appeared outside, screaming; Y gave a series of *tiks* for about a minute.

Mounted Barred Owl with movable wings.—On May 16 when the model was stationary, Y showed strong alarm (133 *tchunks*). After a five-minute interval the owl was again shown, but this time the wings were moved up and down. Y showed fear (94 *tiks* and 20 *tchunks*) and tried to escape. On May 27 with the model stationary Y gave 113 *tchunks* and three *tiks*; then the wings were moved and Y showed fear with 70 *tiks* in one minute, in the meantime flying back and forth in the cage.

Flying models.—Flying models were shown outside the window, one in the shape of an *Accipiter*, the other a rectangle. At the first sight Y showed momentary fear. As long as the models moved slowly, there was no distinct reaction. If the models were rapidly moved, Y showed fear at both. Apparently sudden movement and not form frightened him.

Models brought suddenly to the cage.—Several objects were shown suddenly and with movement for about four seconds. They were presented in the following order: mounted Burrowing Owl, rectangular piece of cardboard, small cardboard model of owl (Plate 8, fig. 2, no. 1), unpainted side of the same model, painted side, piece of cardboard. Y reacted with fright to the mounted owl and the painted side of the model, but was attentive and, during the last test, slightly alarmed by the piece of cardboard and the unpainted model.

Stationary Enemies

In none of the experiments with the stationary models did the birds show any greater reaction than strong alarm. All experiments were characterized by a gradual decrease of the reaction. This is well illustrated in charts 1 and 2.

Mounted Barred Owl.—On February 1, the mounted Barred Owl was shown in the study; Y was strongly alarmed, while the female J elongated herself. On February 25, it was displayed on the victrola; Y was strongly alarmed; with tail flipping and crest raised, he gave about nine *tiks* and 60 *tchunks* in a minute. J raised her crest and flirted her tail (she never gave the notes *tchunk* or *tik*). After five minutes the owl was removed, but Y gave about 36 *tchunks* a minute for the next two minutes. From April 2 to 12, tests with mounted birds were given every other day; on the latter date the owl was shown and evoked only moderate alarm with 114 *tchunks* in the first three minutes; however, there was no cessation of *tchunks* during the 15-minute experiment, 405 being given in this period; of the eight objects shown it was only with the owl and the hornbill that *tchunks* were given throughout the 15 minutes. On May 15, the owl was used as the standard in the series of three-minute tests; the number of *tchunks* given showed a marked decrease, namely, 138, 102, 73.

Interestingly enough, this mount invariably evoked strong alarm in both Y and D when it stood on the piano in the front room. This was true on five occasions from February 6–15 when D saw it in this situation and six times between March 23 and May 24, when Y had this experience. For example, on April 12, Y went into the

middle room, reached the point from which he caught sight of the owl, and with crest up and tail flirted, gave 202 *tchunks* in 225 seconds, and flew back into the study. On four of Y's six visits an exact record of *tchunks* was kept; the counts were high: 166, 158, 214, 161.

Apparently the birds were conditioned after these experiments to the situation, for they showed alarm merely at the sight of the piano, when the owl was absent. D showed strong alarm on the afternoon of February 15, when he found the owl absent after six visits during the previous nine days on all of which the owl had been present. On April 4, Y reacted with moderate alarm to the absence of the owl, after having seen it March 23 and April 1. His reaction to its reappearance on April 12 has already been described. On his next visit, May 8, the owl had been removed; he entered the room keeping his eyes on the spot where the owl had been displayed, and showed strong alarm, giving 180 *tchunks* in the first three minutes, after which he fell silent, gradually gave up signs of alarm, and nine minutes after entering the room began to sing softly within three meters of the piano. The owl was present at his next three visits (May 20-24), but absent May 31; on this occasion Y gave the following number of *tchunks* per minute: 49, 38, 22, 15, 5, 2, after which he returned to the study.

After more than four months Y was still conditioned to this spot. During most of the summer he had lived in another house. He had not seen the owl on the piano since May 24. On October 1, he entered the front room, at once showed strong alarm with crest and tail raised, keeping his eyes on the end of the piano. He gave 148 *tchunks* in three minutes, left the front room and gave nine more before he returned to the study.

In the fall we used a different mounted specimen and found the reaction of Y to this specimen much weaker than it had been to the first specimen or to the cardboard models of owls. On October 11, at the end of a short series of tests he showed only weak alarm (44 *tchunks*) to the mount, although the 'best' cardboard model (Plate 8, fig. 2, no. 3) was as effective as in the spring (115 *tchunks*). In our eyes this second mount seems a poor specimen. On October 16, we placed this owl on the piano; Y, on entering the room, raised his crest and flirted his tail and gave 42 *tchunks* in the first minute and 43 in the second, after which he flew back to the study where he gave 13 more *tchunks*.

Other mounted birds.—Tests were made with a number of mounted birds for the sake of comparison with the reactions to the mounted

Barred Owl. In general these birds caused less-marked alarm. A mounted hornbill, about 40 cm. long, grayish in color, evoked the strongest reaction of any of these specimens, causing strong alarm in Y at the first test (154 *tchunks*), and moderate alarm (117 *tchunks*) at the second. A kite (*Chondrohierax*) caused moderate alarm (123 and 118 *tchunks*). A falcon (*Micrastur*) and a Burrowing Owl (*Speotyto*) evoked moderate alarm (93–109 *tchunks*), although in one test (May 22) Y showed no reaction to this owl, which, it should be noted, was a decidedly poor mount. A Ruffed Grouse (*Bonasa umbellus*) gave inconsistent results: strong alarm at the first test (April 1) and weak (47 *tchunks*) five days later; on May 22, it evoked 70 *tchunks* in the first test and none in a second test ten minutes later.

Observations in Nature show that Song Sparrows on their territories react with strong alarm to the visits of female Cowbirds. On September 26, a mounted female Cowbird was placed 30 cm. from Y's cage; Y gave 83 *tchunks* (moderate alarm). On October 6, we compared the reaction to the mounted Cowbird with that to a mounted Starling (*Sturnus vulgaris*); Y showed weak alarm to the former (37 *tchunks*) and moderate alarm to the latter (90 and 116 *tchunks*). It seems probable that the strong alarm shown to Cowbirds in Nature is based on experience.

Cardboard models.—Since the reaction to the Barred Owl was so much more pronounced than to the other birds, we asked ourselves what the difference might be to the Song Sparrow between the owl and the other birds. In an attempt to answer this question we made a series of models, cut out of cardboard and painted on one side with India ink and crayon. These models were shown on the victrola in three-minute tests.

The 'best' model (Plate 8, fig. 2, no. 3) was as far as possible a copy of the mounted owl. Y reacted to this model as much as to the mounted owl in the same situation, showing for the most part moderate alarm (94, 115; 148, 128, 102, 124; 103, 97, 98; 121; 116 *tchunks* on five different days). The same model was shown with the eyes covered; Y gave 93 *tchunks*. A piece of plain cardboard of the same shape was shown; Y gave 16 *tchunks* in the first test and one in the second. To find out whether the size of the owl was important, we made a reproduction of the 'best' model at half scale (Plate 8, fig. 2, no. 1). Y showed moderate alarm with 92 *tchunks* on May 17 and weak alarm with 34 *tchunks* five days later. To a piece of cardboard with the same outline Y gave no reaction. The model we used most often as a standard was the 'head' model (Plate 8, fig. 2, no. 2), a reproduction of the head of the 'best' model with a slender

unpainted body. This model proved to be almost as effective as the 'best' model, evoking mostly moderate alarm (119; 133, 107, 94, 114; 97, 92, 94; 152, 125, 114, 68; 83, 72; 53; 72; 91, 10 *tchunks*). These series, obtained on eight days between May 15 and 27, illustrate the decrease in the intensity of the reaction during this period. Two tests made in the fall showed moderate alarm (93 and 97 *tchunks*). A piece of plain cardboard of the same shape as the 'head' model (the 'outline') (Plate 8, fig. 2, no. 5) provoked no reaction in nine tests and very weak alarm (14 *tchunks*) in one. So there is a remarkable difference between the results with the painted and unpainted models.

We attempted to analyze this difference and in this way to find the essential feature in the owl. The 'head' model without eyes (Plate 8, fig. 2, no. 4) evoked moderate alarm (104 *tchunks*). The 'head' model placed upside down brought 76 *tchunks*. Reactions were similar to a model of which only the left half was painted (77, 82 *tchunks*). A model with only some shading on the head evoked 53, 27 and 0 *tchunks*, and when eyes were added no reaction was given. A model with only some shading on the breast brought 13, 66 and 0 *tchunks*. A model with a dark border around the outline evoked no reaction, but a similar model with some shading along the outline, so that it seemed to be rounded (Plate 8, fig. 2, no. 6) brought 94 *tchunks*. A piece of cardboard of the same size as the 'head' model was gradually changed and shown at intervals. Eyes, bill and disks around the eyes brought no reaction, but as soon as some shading was added that gave contour to the model, Y showed moderate alarm, uttering 85 *tchunks*. Similar models were made of various birds: duck, kite, duck hawk, quail and shorebird; all of these caused some alarm (67-99 *tchunks*). Tests on October 11 gave the following figures: shorebird, 64 *tchunks*; duck hawk, 118, 99.

Other objects.—In order to interpret the results obtained with the mounts and models, it is of interest to know how the birds react to new objects in their environment. Ordinarily the hand-raised Song Sparrows have been indifferent to new objects brought into the room. Some objects, however, evidently have a special meaning, as have some of the cardboard models. On February 9, a teddy-bear about 30 cm. high was placed a meter and half from the cage; D showed strong alarm (33 *tchunks* in 30 seconds), while J raised her crest. In similar tests Y showed moderate alarm on April 4 (108 *tchunks*) and weak alarm on April 15 (58 *tchunks*), but on October 8 he reacted with strong alarm (127 *tchunks*) and the next day with moderate alarm (84 *tchunks*). To a 20-cm.-high pewter pitcher Y

reacted with moderate alarm for two minutes, giving 67 *tchunks*, after that becoming indifferent.

Notes of owls.—Birds in Nature sometimes respond to notes of hawks and owls and even to imitations of these. On October 11, Mr. J. Murray Spiers gave excellent imitations of the hoots of Great Horned, Barred and Barn Owls and also of the cry of the Red-shouldered Hawk, without eliciting any response from Y.

Experiments with Goldfinches.—A few experiments were made with two hand-raised Goldfinches when they were one year old. A series of objects was shown but no reaction was given to the teddy-bear, nor to any of the cardboard models, but the mounted Barred Owl evoked fright, both birds flying rapidly about. After a five-minute interval the 'best' model was shown again; now the birds flew back and forth. Somewhat similar reactions, but weaker, were shown to the other models, the male evincing much more concern than the female. With this species it is difficult to measure the degree of excitement.

EXPERIMENTS WITH YOUNG SONG SPARROWS

During three summers Song Sparrows have been raised by hand, being taken from the nest at the age of five to seven days. Situations to which these birds instinctively responded with escape reactions were: threatened capture, movement of the immediate environment, approach of very large moving objects, evidence of fright in companions, sight of birds flying overhead, the specific fear note, and sounds resembling it.

During their fourth week one brood (Y and his brothers) did not recognize a cat or a dog as an enemy; the same was true with the male A when 75 to 80 days old. A horned toad (*Phrynosoma*) and ground squirrel (*Citellus tridecemlineatus*) to which the brood were introduced at the age of one month evoked curiosity.

During 1940, a mounted Barred Owl was shown to four young birds: to three of them at intervals from 7 to 21 days, to A at 7, 17, 21, 28, 32, 37, 50 and 62 days. Three of the cardboard models of owls were also shown during the last three experiments. All tests gave negative results. When A was three months old he was shown a series of models and the mounted Cowbird, Starling and Barred Owl. To none of these did he react except in two instances: he gave 61 *tchunks* in three minutes to the outline of the owl with the dark shading (Plate 8, fig. 2, no. 6), but in a second test gave no reaction; to the Cowbird he gave 52 *tchunks* at the first showing, but no reaction in the second. A has been shown the owl once a month up to

the age of seven months and is still indifferent. Unfortunately A has always been a sub-normal bird; this is clearly shown by the fact, that, although his wing measurement shows him to be a male, he has never sung, while the four other hand-raised birds sang a great deal in their first fall and winter.

The experiments with the adult Song Sparrows cannot be explained without postulating an inborn pattern, but possibly this pattern appears late.

DISCUSSION

Apparently the Song Sparrow recognizes enemies by both inborn and learned patterns. In Nature the behavior of the adults is of great importance for the forming of conditioned patterns in the young. Simultaneous presentation of a natively inadequate stimulus (cat, Cowbird) and the unconditioned stimulus (alarm of the adult) may result in conditioning to the originally inadequate stimulus.

Evidently inborn is enemy recognition of large, new, moving objects, and specifically of an owl.

Evidently learned, either from personal experience or from reactions of others, is enemy recognition of cat and Cowbird. On the other hand, the birds may learn in one or both ways what is *not* an enemy. The experiments show decrease of inborn reaction when nothing happens after the enemy has been shown. A similar process may be involved in the absence of alarm shown for rabbits and often for Sparrow Hawks (*Falco sparverius*) in Nature.

Conditioning was certainly an important factor in the experiments. Why did the situation in the front room bring such a marked reaction? One of the factors was undoubtedly the familiarity of the environment in the study and the unfamiliarity of that in the front room. Most of Y's experiences in the study had nothing to do with enemies, but after March 23 the owl was the most important element of the front room for Y. Lorenz (1935: 205) describes how his Ravens (*Corvus corax*) were conditioned against places where they had been frightened. The experience of Mrs. Laskey shows how quickly a Mockingbird was conditioned to the place where an owl had perched.

Although the victrola evidently had a neutral tone when displaying indifferent models, there was, however, probably some influence from the owl that was reflected in the reaction to other mounts and to some of the models. It is not clear if the characteristics of the owl pattern—head and shading—are characteristics of the inborn owl pattern or merely elements of previous experience.

SUMMARY

1. A survey is given of previous observations on the relation 'enemy-prey' from the viewpoint of the prey. Fear reactions to owls have been reported in hand-raised individuals of *Passer domesticus*, *Corvus monedula*, *Mimus polyglottos*, and to hawks in *Corvus monedula*, *Tetrastes*, *Lagopus*, geese and ducks.

2. In the Song Sparrow it is possible to differentiate stages of 'alarm,' 'fear,' and 'fright.'

3. In Nature, the most important enemies of the Song Sparrow are probably cats, hawks and owls.

4. Cats arouse strong alarm from Song Sparrows in Nature. Young hand-raised birds showed no alarm, while an adult male showed moderate alarm in September and weak alarm the following April, but after experience with cats in the summer he showed strong alarm.

5. In Nature Sparrow Hawks (*Falco sparverius*) occasionally aroused alarm or fear, but were usually ignored. Other hawks provoked fright. With the hand-raised male, stationary models of hawks evoked moderate alarm, rapidly moving models fright.

6. A wild Song Sparrow showed fear in the presence of a mounted Barred Owl. Young hand-raised birds up to the age of three weeks gave no fear reaction to a mounted owl. Adult hand-raised males showed strong alarm to a stationary model of an owl and fear to moving models.

7. Tests with cardboard models showed that the pattern of the owl is a totality in which the head and shading are most important.

8. Other mounted birds and cardboard models evoked moderate or weak alarm.

9. In Nature the Cowbird (*Molothrus ater*) evokes strong alarm from Song Sparrows on their territories. It is questionable if this is based on an inborn pattern. The hand-raised male Song Sparrow, tested in autumn, showed only moderate and weak alarm to a mounted female Cowbird.

10. Snakes evoked curiosity in a hand-raised Song Sparrow and also in a wild male. Small snakes were treated as nest enemies by a wild female.

11. Memory has been shown to be of great importance in enemy recognition. In our experiments we found that the memory of circumstances connected with strong alarm persisted after several months (the piano without the owl).

12. 'Unpleasant' experience with an enemy will intensify the reaction, while indifferent experience will weaken the reaction.

13. We think that owls are recognized by Song Sparrows in Nature largely through an inborn pattern, hawks through fast movements, and cats and possibly Cowbirds after conditioning.

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DEVELOPMENT OF NESTLING YELLOW-HEADED BLACKBIRDS¹

BY REED W. FAUTIN

INTRODUCTION

VERY little information is available in the literature concerning the development of the Yellow-headed Blackbird, *Xanthocephalus xanthocephalus*. Most references to this species are merely incidental, pertaining to various phases of its life history and distribution. Dr. T. S. Roberts in 1908 was the first to give this bird any serious consideration when he kept a colony of them under observation for a period of thirty-two days. The most comprehensive study of the Yellow-headed Blackbird was made by George A. Ammann (manuscript, 1938) during the years from 1933 to 1935 inclusive in the vicinity of Ruthven, Iowa, but so far as the writer knows, the results of his investigation have not yet been published.

The present paper is based on an investigation of two colonies of Yellow-headed Blackbirds in the vicinity of Utah Lake about five miles west of Provo, Utah, during the spring and summer of 1937. One hundred and twenty-eight nests were kept under observation from the time they were constructed until the nestlings left them. The larger of the two colonies, containing eighty-four nests, was located at the mouth of the Provo River on the east shore of Utah Lake and will be referred to as the 'Provo River colony'; the smaller colony, containing forty-four nests, was located northeast of the Provo River colony, about two miles east of Utah Lake in a small bulrush marsh, and will be referred to as the 'Lakeview colony.'

The nests were visited daily and the progress of each, including the weights of the nestlings, was recorded. Observations on the behavior of individual males and females and their care of the young were made from blinds. Development of the young was followed until after the time they left the nesting area.

HATCHING

Hatching began at approximately the same time in both colonies, namely, May 19 in the Provo River colony and May 21 in the Lakeview colony; it ended June 24 (Text-fig. 1). The greatest number

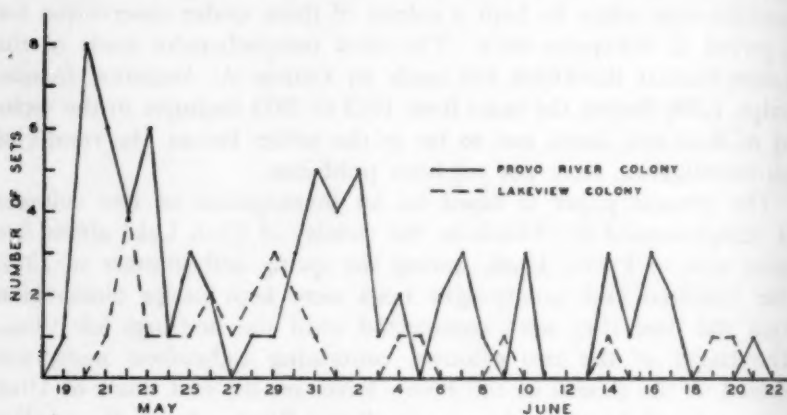
¹ Contribution No. 568 from the Department of Zoology of the University of Illinois and No. 84 from the Department of Entomology and Zoology of the Brigham Young University, Provo, Utah.

of clutches began to hatch at the first of the hatching period (Text-fig. 1) and gradually decreased until June 21.

Of all the eggs laid, 129 or 29 per cent failed to hatch with the result that only 314 young were produced from a total of 443 eggs. Of these 443 eggs, 90 or 20 per cent, were destroyed or disappeared from the nests before they had time to hatch. The other 9 per cent failed to hatch because of being addled or infertile.

GROWTH OF THE NESTLINGS

The newly hatched young are yellowish pink in color, blind, and helpless; they are practically naked except for a few scattered patches



TEXT-FIG. 1.—Daily number of clutches to begin hatching throughout the nesting season.

of neossoptiles on certain regions of their bodies. The neossoptiles do not seem to grow after the time of hatching but apparently are fully developed at the time the young birds emerge from the egg. These downy feathers are soon pushed out by the incoming teleoptiles to which some of them remain conspicuously attached, especially on the top of the head. The most conspicuous patches of neossoptiles occur on the coronal and occipital regions of the head and on the pelvic and dorsal regions of the spinal tract. Two less-noticeable patches occur on each wing and narrow oblong patches are found along the region of the upper part of the femoral tracts and on the abdominal region of the ventral tracts. A very narrow ring of neossoptiles encircles the legs at the lower part of the crural tract.

The large mouths of the newly hatched young are lined with

bright red and the corners, which protrude beyond the sides of the head, are a conspicuous yellowish white.

Weights of the nestlings were recorded daily or in some instances only every two days throughout the period that the young remained in the nest. In order to identify each individual in the nest, threads of different colors were tied around their legs at the time they were first weighed. On the day of hatching the young varied in weight from 2.6 to 4.8 grams, depending on the time of day when they had hatched before being weighed, with an average of 3.7 grams. Those that had just emerged from the egg weighed 2.6 to 3.6 grams, with 3.3 grams as the most frequent weight.

The study of growth rates was of necessity limited to the period during which the nestlings remained in the nests; this averaged about ten days. The greatest average increase in weight per day occurred between the fifth and sixth days, and amounted to 6.0 grams (Text-fig. 2, A). An average gain in weight of 5.2 grams per day was made during the period when the nestlings were from three to seven days old, whereas the average increase per day from the time of hatching up to twelve days of age was 4.2 grams. During a cold rainstorm which lasted for sixteen hours some of the nestlings lost as much as 2.3 grams in body weight and most of those that survived added little or no weight during that time. The percentage of growth per day was greatest the first day after hatching when it averaged about 60 per cent, and in the case of one brood reached 94 per cent (Text-fig. 2, B). As the nestlings grew older the percentage of gain in body weight gradually decreased until by the ninth day it was down to about 5 per cent.

The rate of growth varied considerably in different broods and in different individuals of the same brood. Nestlings of the same age varied as much as 15 to 20 grams in weight by the time they left the nest; at that time the smaller ones were as well feathered and as able in handling themselves as the larger ones. Inasmuch as there is a great difference in the size of the adult males and females, the western birds averaging 91.4 grams and 56.4 grams respectively (Ammann, 1938), it is quite probable that this difference in the size of the nestlings is due to difference in sex although their plumage shows no sexual differentiation until after the post-juvinal molt. On the basis of this difference in the size of nestlings of the same age, the sex ratio of the nestlings was estimated as 51 per cent females in the Lakeview colony and 55 per cent females in the Provo River colony.

As is indicated by the growth curve (Text-fig. 2, A), the nestlings

do not reach the size of the adult before leaving the nest but continue to grow for some time thereafter. The maximum weight of male nestlings at the time they left the nests was 60 grams with an average of 54 grams, which is only 59 per cent as heavy as the adult males; that of the nestling females was 40 grams with an average of 36 grams, or 64 per cent of the weight of the adult females. This is probably due to the fact that the young birds leave the nest at a very early age (about ten days), before they have reached their full development, as will be seen later.

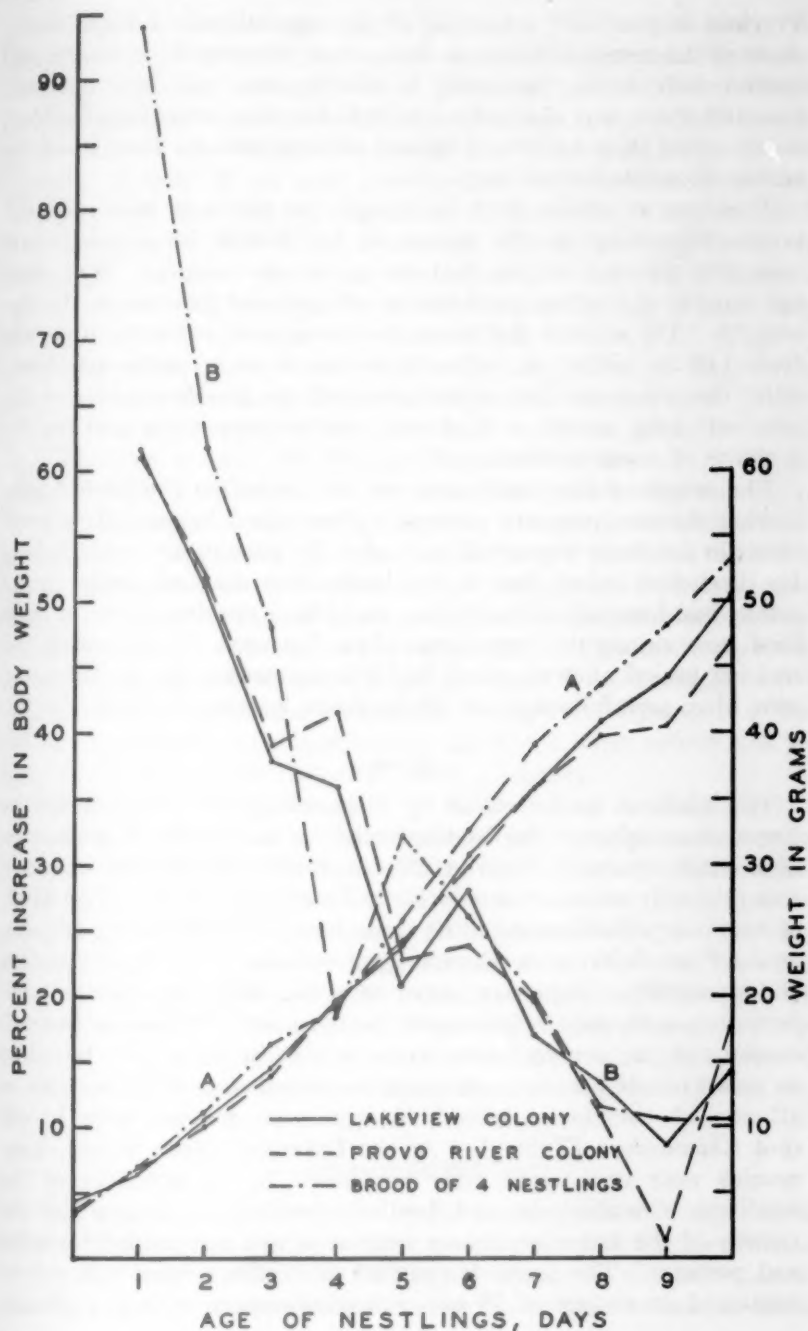
According to Ammann (1938) the growth of the juvenal plumage is completed by the twenty-fifth day; at this time the post-juvenal molt is well under way although the remiges and rectrices are not fully developed until the young are about forty days old.

CARE OF THE YOUNG

The young are brooded by the females during the day for only two or three days after hatching; the amount of time spent by the females in brooding their young does not exceed 25 per cent. After the nestlings are three to five days old they are not actually brooded but the females often stand over the nest with outstretched wings to afford protection to the nestlings from the direct rays of the sun. Although no observations were made after dark it is probable that the young are brooded at night.

For the first day or two after the young are hatched they are fed either by regurgitation or else on food materials so small that they escaped notice, for during that time the females were seldom seen carrying food in their mouths although the young were visited six to seven times per hour. Probably they were fed by regurgitation during that time, since Wheelock (1905) reports that the young are fed by this method during the first two days after hatching. The younger nestlings receive small articles of food such as spiders and small beetles but as they become older, larger insects such as grasshoppers, damselflies and dragonflies constitute a large part of their food.

When the nestlings are young the food is usually divided between two or more members of the brood but as they become older an entire mouthful of insects or one entire large insect such as a dragonfly or a grasshopper may be given to one individual. Those that are fed first are the ones whose vigor in giving the response for food is greatest. This response is present from the first day the young are hatched and is evidently initiated by stimuli of sound and touch because the eyes do not open until the third day after hatching.



TEXT-FIG. 2.—Growth rates of Yellow-headed Blackbird nestlings. *A*, average daily increase in body weight (in grams); *B*, average daily percentage increase in body weight.

Previous to that time a rustling of the vegetation or a slight movement of the nest is sufficient to cause them to open their mouths and extend their necks. So strong is this response that nestlings only two and three days old and so chilled that they were actually blue, feebly raised their heads and opened their mouths for food when the writer approached their nest.

The rate at which food is brought to the nest varies considerably depending on the success of the female in locating food materials, the time of day, and the age of the nestlings. The average number of feedings per hour for all ages and all times of the day was 9.6. The time of day when the young were fed least often was from 1.00 to 4.00 p. m., when it amounted to 7.1 times per hour. After the young are four to five days old, the female remains at the nest only long enough to feed them and to inspect the nest for the presence of waste materials.

The length of time the young are fed, including the period after leaving the nest, was not accurately determined because they move about in the dense vegetation so much. No young were seen foraging for themselves before four to five weeks after the first young in the colony had hatched, although they could have obtained some of their food from among the vegetation before that time. Even during the molting period after the birds had left the nesting areas, the young were often seen following the adults about, coaxing for food.

FOOD

The kinds of food received by the nestlings were determined by direct observation of the feeding activities and by the examination of stomach contents. Both of these methods revealed that the food was primarily animal matter, chiefly insects (Table 1). The kinds of insects received seemed to be those most available to the females. In the Provo River area where midges (*Chironomus*) were abundant and damselflies (Zygoptera) were common, these two insects were most frequently seen being carried to the nests. When the stomach contents of the nestlings were examined, *Chironomus* was found to be present in 41 per cent and constituted an average of 22 per cent of all stomach contents examined; some stomach contents were 84 per cent *Chironomus* (Table 1). At the Lakeview colony where chironomids were very scarce none was found in the stomachs of the nestlings. Grasshoppers and beetles were very abundant in the vicinity of the Lakeview colony because it was surrounded by fields and pastures. The stomach contents of nestlings from this colony contained an average of 39 per cent grasshoppers, with a maximum

of 84 per cent, and an average of 18 per cent beetles with the grasshoppers occurring in 87 per cent of the stomachs examined and the beetles in 75 per cent (Table 1). Inasmuch as the Provo River colony was situated on the shore of a lake these two groups of insects were not so abundant and the stomachs of the young contained an average of only 12 per cent grasshoppers and 17 per cent beetles; the former occurred in only 9 per cent of the stomachs and the latter in 76 per cent. This high percentage of occurrence of beetles is due to the presence of water beetles (*Hydrophilidae* and *Dytiscidae*), while the ground beetles (*Carabidae*) occurred in only 29 per cent of the stomachs and constituted only 4 per cent of their contents.

These results indicate that the food of the young is obtained by the females within the immediate vicinity of the nesting areas. Open fields were within a quarter-mile of the Provo River colony and large open marshes within a like distance from the Lakeview colony, yet the principal kinds of insect food found in those places were very scarce in the stomachs of the young from these respective colonies. Observations of individual females also indicated that they obtained most of the food within comparatively short distances of their nests.

The literature on the food of young Yellow-headed Blackbirds indicates that it is entirely animal matter but in this study vegetable material, chiefly grass-seeds and grain (*Poaceae*, *Triodia*, and *Hordeum vulgare*), were found to constitute an average of 1.6 per cent of the stomach contents of the nestlings in the Provo River colony and 7.6 per cent of those in the Lakeview colony (Table 1).

Mollusks are also occasionally fed to the young, occurring in 37.8 per cent of the stomachs examined and constituting an average of 1.25 per cent of their contents (Table 1). Wheelock (1905) found that snails, water slugs, and larvae were included in the diet of the young 'Yellow-head.' Gabrielson (1914a) found that 62 per cent of all insects fed to the nestlings were mayflies. Some of the other insects he observed being carried to the nests were larvae, dragonflies, and grasshoppers. Roberts (1909) gives grasshoppers and "a large black larva of some sort which was obtained from among the decayed vegetation in the shallow water along the edge of the slough" as constituting the chief food supply of the nestlings.

SANITATION OF THE NEST

The nests are kept very clean by the females. In only three nests, when the young were ready to leave, was there any noticeable accumulation of excreta. After each feeding the female usually probes about in the bottom of the nest for waste materials or waits on the rim of the

TABLE 1—Continued
FOOD OF NESTLINGS BY VOLUME PERCENTAGES

| Age of nestlings (days) | 1-2 | 3-4 | 5-6 | 7-8 | 9-10 | 11-12 | Average per cent | Maximum per cent | Per cent frequency |
|------------------------------|------|------|------|------|------|-------|------------------|------------------|--------------------|
| Coleoptera (total)..... | | | 6.7 | 23.4 | 32.5 | 3.0 | 15.3 | 95.0 | 54.0 |
| 1. Cicindellidae..... | | | 0.3 | 2.5 | 4.5 | T | 9.3 | 6.0 | 28.0 |
| 2. Carabidae..... | | | 0.8 | 0.4 | 2.5 | T | 2.0 | 5.0 | 6.0 |
| 3. Hydrophilidae..... | | T | 0.6 | 19.0 | 25.5 | 0.5 | 2.0 | 3.0 | 51.0 |
| 4. Hydrophilidae larvae..... | | | 5.0 | | | T | 1.7 | 94.0 | 5.0 |
| 5. Elateridae..... | | | | | | | 14.5 | T | 41.0 |
| 6. Scarabaeidae..... | | | | | | | 0.3 | 6.0 | 1.0 |
| 7. Curculionidae..... | | | T | 0.4 | | | | 3.0 | 31.0 |
| 8. Dytiscidae (larvae)..... | | | T | 1.1 | | 2.5 | | 4.0 | |
| Lepidoptera (total)..... | | | | 5.0 | 19.0 | T | 1.5 | 25.0 | 38.0 |
| 1. Lepidopterous larvae..... | | | | | | T | | 38.0 | 6.0 |
| Diptera (total)..... | 26.0 | 38.0 | 23.5 | 31.2 | | | 22.0 | 84.0 | 52.0 |
| 1. Chironomidae..... | | 38.0 | 23.5 | 31.2 | | | 22.0 | 84.0 | 41.0 |
| 2. Tabanidae..... | 26.0 | | | | | | | | 52.0 |
| 3. Misc. fragments..... | | T | 5.8 | 6.4 | 1.0 | | 1.6 | T | |
| Hymenoptera (total)..... | 3.5 | 0.5 | | | | 1.6 | 2.1 | 32.0 | 7.0 |
| 1. Eurytomidae..... | | 0.5 | | | | | | 1.0 | |
| 2. Formicidae..... | 3.5 | | 0.5 | T | 1.0 | 1.6 | | 2.0 | 7.0 |
| 3. Sphecidae..... | | | T | 3.0 | | | | T | |
| 4. Apoidea..... | | | | 3.4 | | | | 17.0 | |
| 5. Andrenidae..... | | | 5.3 | | | | | 32.0 | T |
| 6. Misc. fragments..... | T | | | | | | | | |

"T" indicates a trace (less than 0.1 per cent).

nest for the fecal sacs to be extruded. From the time the young are first hatched until they are three or four days old the fecal sacs are frequently swallowed by the females but as the young become older these sacs are carried a short distance from the nest and dropped.

RÔLE OF THE MALE

The males aid very little in caring for the nestlings. Only two males were observed to make any attempt to feed the young. One of these fed the young eight times during a period of eight hours and six minutes while the female fed them 102 times during the same interval. The other male fed another brood of nestlings eight times while the female fed them 92 times during the same period. No young were observed being fed by the males before they were six days old. Roberts (1909) observed males feeding the young to a limited extent, both in the nest and after they had left, but Gabrielson (1914a) failed to find any males feeding the young or carrying food that might have been intended for them.

The females seem to excel the males in the care of the young. If a female is present at the nest the male will wait until she has left before approaching with food. If the male is present at the nest when the female arrives he immediately leaves.

Coues (1874) reports that the males desert the females during the time of incubation and caring for the young; however, the observations of others, including Roberts (1909), Gabrielson (1914b), Ridgway (1889), Linsdale (1938), and Ammann (1938), do not confirm this statement. The males often fly into the neighboring areas to feed but they return to their respective territories after a short time (Fautin, 1940). Records of the time spent in and out of their territories revealed that on an average the males spent 55 per cent of their time within their territories and 45 per cent outside.

LEAVING THE NEST

The young, when about ten days old, are often found perching on the rim of the nest and frequently hop down into the vegetation when the nest is approached. Although no young were seen to leave the nests voluntarily, the nests were found to be abandoned when the young were nine to twelve days old. Roberts (1932) states that the young remain in the nest for about twelve days and Ammann (1938) found that they leave at all ages varying from seven to fourteen days but that the usual age of leaving is about eleven days.

Under certain circumstances, as when the nest is destroyed by a storm or tipped over, the young are forced to leave sooner than they normally

would. Under such conditions they were found to survive if they were not less than eight days of age. Where there are four nestlings, the nest becomes so well filled by the time the young are eight to ten days old that it is almost impossible to fit them back into it again after they have been removed. Such crowded quarters probably exert some influence in forcing them to leave somewhat sooner than otherwise. Thus nests containing four or five young were often abandoned a day or two earlier than nests containing smaller broods. All of the young usually left the nest at about the same time but not infrequently some left before others. Young which were hatched on the same day usually left the nest on the same day.

The young are unable to fly at the time they leave the nest but they are very adept at making their way through the vegetation. After abandoning the nest they never return to it but are to be found among the vegetation down near the surface of the water, sometimes sitting on the dead floating vegetation. The color of the nestlings blends very well with the dried stalks and leaves of the vegetation so that when remaining quiet they are very difficult to find. After leaving the nest they remain in the vegetation until they learn to fly. For the first four or five days they move about by hopping from one stem or leaf to another with remarkable agility. Following this hopping stage they make short flights of about two to four feet and thus gradually develop their ability to fly. By the time they are three weeks old they are frequently seen to make short flights of about 25 yards. From this stage on, their ability to fly develops very rapidly and they are soon seen pursuing their parents, coaxing noisily for food.

MORTALITY

The toll of nestlings taken by natural forces and by certain undetermined natural enemies of the Yellow-headed Blackbird is very heavy. In this study, cold rainstorms accompanied by wind were one of the primary causes of the destruction of the young (Table 2). Only one such storm occurred during the nesting season but it left in its wake a high percentage of destroyed nests, eggs and young. The percentage of nestling mortality attributed to the direct effects of this storm, based on the number of young in the nests at the time of the storm's occurrence, May 30, amounted to 39 per cent in the Provo River colony and 22 per cent in the Lakeview colony. The difference in the mortality of these two colonies was largely due to differences in the kinds of vegetation present and to a possible difference in the intensity of the storm at the two places. The tamarisks (*Tamarix gallica*) and willows (*Salix* sp.) of the Provo River area, being tall

and limber, sway back and forth in the wind with the result that a number of nests were torn away from their moorings allowing their contents to roll into the water. The shorter and more dense bulrush stalks (*Scirpus validus*), in which the Lakeview colony was situated, were less subject to being whipped by the wind and the nests were placed down nearer the surface of the water. In the Provo River colony four nests were completely destroyed and seven others torn loose and tipped over, whereas only one nest was damaged in the Lakeview colony.

This storm also killed many nestlings without destroying the nests (Table 2). In some nests all of the young were killed while in others part of them managed to survive. The nestlings that suffered most were those from three to six days of age. Those younger than that received the protection of the more constantly brooding females and those older than six days were well enough protected by their own feathers and the development of body temperature-regulating mechanisms to enable them to survive.

In both colonies many nestlings disappeared suddenly, leaving no clues as to their fate. Roberts (1909) reports that the entire progeny of a colony in Minnesota was destroyed by some agency, the identity of which he was unable to determine. Thompson (1934) and Linsdale (1938) also refer to nests being emptied of their contents. Some of the young may have been removed alive by the females because one female was seen to perform such an act. Others may have died from exposure, neglect, internal parasites, crowding or other causes and then been removed by the females. Still another possibility is that some of them were taken by snakes. Dawson (1923) found a bull snake coiled up beneath the nest of a Yellow-headed Blackbird in California and Ammann (1938) found a garter snake in the act of swallowing a nestling in Iowa.

In the Lakeview colony 19 per cent of the young were found dead in the nests and partly eaten. In most instances they were not dismembered but the flesh had all been removed from the bones. Since no ants were found in the nests some small animal, whose weight could be supported by the vegetation, may have been responsible for such depredations. The navigator shrew (*Neosorex palustris navigator*) was suspected of these losses but this could not be proved.

Other nestlings were found dead in the nests apparently because of neglect or desertion by the females. Weydemeyer (1936) and Ammann (1938) have found similar cases of mortality. Flooding of nests has been listed as one of the major causes of nestling mortality by Henninger (1915) in Wyoming and by Gabrielson (1914b) and Ammann

TABLE 2

FACTORS CONTRIBUTING TO THE MORTALITY OF NESTLINGS

| <i>Causes of mortality</i> | <i>Provo River Colony</i> | | <i>Lakeview Colony</i> | |
|--|---------------------------|-----------------|-------------------------|-----------------|
| | <i>No. of nestlings</i> | <i>Per cent</i> | <i>No. of nestlings</i> | <i>Per cent</i> |
| Nests completely destroyed by storm | 6 | 2.6 | 0 | 0 |
| Nestlings dead in nest (cause unknown) | 8 | 3.5 | 2 | 2.3 |
| Nestlings suddenly disappearing from nest (cause undetermined) | 71 | 31.1 | 27 | 31.4 |
| Nestlings missing after storm but nest not destroyed | 10 | 4.3 | 8 | 9.3 |
| All young killed by storm (remaining in nest) | 8 | 3.5 | 0 | 0 |
| Part of young killed by storm (remaining in nest) | 17 | 7.4 | 4 | 4.6 |
| Nest tipped over causing nestlings to fall out | 21 | 9.2 | 0 | 0 |
| All young dead in nest (apparently due to exposure or neglect) | 8 | 3.5 | 0 | 0 |
| Female removed living nestlings from nest while being observed | 3 | 1.3 | 0 | 0 |
| Died from large blister on side of body (sunburn) | 1 | 0.4 | 0 | 0 |
| Nestlings all dead in nest—partly eaten (cause undetermined) | 0 | 0 | 16 | 18.6 |
| Part of nestlings dead in nest and partly eaten | 0 | 0 | 3 | 3.5 |
| Drowned | 0 | 0 | 2 | 2.3 |
| Total mortality | 153 | 66.8 | 62 | 72.0 |
| Mortality due to storm May 30 | 41 | *39.2 | 12 | *21.6 |

* Percentages are based on number of nestlings at time of storm and not on the total number of the colony.

(1938) in Iowa. This is probably an important cause of mortality in areas where considerable fluctuations of the water level occur. Other minor causes of mortality are exposure to the sun and drowning. A number of nestlings were found floating in the water below the nest from which they had been frightened or had accidentally fallen.

This study as well as those of Roberts (1909) and Ammann (1938) indicate that the nestling mortality of this species is very high but probably varies from one year to another depending on the weather conditions and the amount of predation. The entire progeny of the colony studied by Roberts in Minnesota was destroyed resulting in a 100 per cent mortality. The nestling mortality of the Provo River colony amounted to 67 per cent and that of the Lakeview colony to 72 per cent, thus giving an average of 69.5 per cent for the two. This is very high in comparison with the nestling mortality of the Song Sparrow as shown in a six-year study by Nice (1937) amounting to 40 per cent and the nestling mortality of Bluebirds (Laskey, 1940) which amounted to 43 per cent in 1938 and 51 per cent in 1939.

Out of 314 nestlings, hatched from 443 eggs, 215 were destroyed before they were old enough to leave the nest. This gives a percentage of success (i. e., young fledged from the total number of eggs laid) of 22.4. This is very low when compared with the average nesting success of 52 per cent for bush- and tree-nesting passerine birds from eleven different studies as compiled by Kalmbach (1939).

From the following table it will be seen that when the nesting success of marsh-nesting birds alone is considered there is a wide range of variation from total failure of the Yellow-headed Blackbird to 78 per cent success in the Red-winged Blackbird.

TABLE 3

| <i>Species and Locality</i> | <i>Reference</i> | <i>No. of nests or eggs</i> | <i>Per cent of success</i> |
|----------------------------------|------------------|-------------------------------------|------------------------------------|
| Red-winged Blackbird (New York) | Allen (1914) | 51 nests | 78 |
| Red-winged Blackbird (Indiana) | Perkins (1928) | 24 nests | 57 |
| Red-winged Blackbird (Louisiana) | Kalmbach (1939) | 281 eggs | 27 |
| Boat-tailed Grackle (Louisiana) | McIlhenny (1937) | 74 nests | 54 |
| Yellow-headed Blackbird (Minn.) | Roberts (1909) | 62 nests | 0 |

Various observers have reported very heavy mortalities for the Tricolored Blackbird, *Agelaius tricolor*. Belding (1890) found many young dead in their nests; Neff (1937) reports whole colonies deserting full sets of eggs and young without any apparent cause and other colonies deserting because of damage done to the cattails and bulrushes by heavy winds; Lack and Emlen (1939) report mass destruction of eggs by some undetermined agent; and Mailliard (1900) suggests that the rapid growth of tules in which nests have been situated has caused desertion of early (low) nests in favor of higher building sites. He also cites heavy predation by Swainson's Hawk (*Buteo swainsoni*). These reports and other causes of mortality that have been previously cited, indicate that the hazards encountered by marsh-nesting birds are varied and numerous and that birds which nest in marshes are subjected to very heavy reproductive losses.

Whether or not the nesting success of the Yellow-headed Blackbird in this study is typical for the species cannot be stated without verification. It is possible that this was an extremely hazardous year for them and that the per cent of success they attained in their nesting is abnormally low. Further investigation is necessary to determine this fact.

After leaving the nest the fledglings move about in the vegetation of the nesting area so that it is extremely difficult to determine their fate

and the mortality which occurs at that time, but there is evidence that some of them do get killed. One was found dead hanging from a willow, having caught one of its feet in the crotch of two branches. Others were found dead in the water. Undoubtedly some fall prey to hawks, owls, weasels, muskrats, and other predators so that the number which actually leave the nesting area is a very small per cent of the number hatched.

POST-NESTING ACTIVITIES

During the molting period which began in July the Yellow-headed Blackbirds left the nesting areas and congregated in large flocks in marshes where the growth of cattails, *Typha latifolia*, and bulrushes was most dense. Here they remained very much in seclusion during the greater part of the day, coming out only in the mornings and evenings to feed. Very often the males were found in one part of the marsh and the females and juvenals in another. This association of the females and juvenals may have been due to the greater attentiveness of the females to the young during their nestling period.

The first-winter plumage of the young is acquired by a partial post-juvinal molt as a result of which the buffy feathers of the head, neck, and breast regions of the fledglings are replaced in the males by yellowish feathers tipped with brownish on the sides of the head, throat, and breast, with a collar sometimes extending around the back of the neck. The feathers of the back, nape, crown and wings are a deep brown while those of the under parts and especially those of the belly and crural regions are somewhat paler around the edges. The autumn plumage acquired by the juvenal females is much the same as that of the adult females.

When the autumn molt was near completion, about August 1, the Yellow-headed Blackbirds, together with other species of blackbirds, came out of hiding and roved about in the fields during the day, returning to the cattail marshes to roost at night.

Migration began about September 1. By September 7 only three females could be located in the vicinity of the study areas. One week later a single juvenal male in a flock of about fifty Brewer's Blackbirds, *Euphagus cyanocephalus cyanocephalus*, was all that could be found and by September 17 all had left the vicinity of the study area.

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SUMMARY

1. Two colonies of Yellow-headed Blackbirds, containing a total of 128 nests were kept under observation from April to September.

2. The development of the young is described from the time of hatching until after they left the nest. The average weight of the nestlings at the time of hatching was 3.3 grams and at ten days of age was 51 grams; the greatest percentage of increase in weight occurred during the first day after hatching, while the greatest actual increase in body weight occurred between the fifth and sixth days, amounting to 6 grams at that time.

3. Feather development began soon after hatching; the sheaths of the primaries appeared the second day. At eight to nine days of age the contour feathers were sufficiently developed to cover all the apteria except possibly the one on the abdomen.

4. Only rarely did the males help in the feeding of the nestlings, whereas the females fed them on an average of 9.6 times per hour.

5. Food of the nestlings consisted principally of insects and spiders. The spiders and smaller insects constituted the greater part of the diet during the first few days after hatching, while larger insects such as dragonflies and grasshoppers together with some vegetable matter formed the bulk of the food as the young became older.

6. The nestlings left the nests when nine to twelve days of age and remained among the dense vegetation of the nesting area until they were able to fly.

7. Mortality of the nestlings was very high, the percentage of young fledged from the number of eggs laid being only 22. Predation and rainstorms accompanied by wind were the two principal causes of mortality.

8. A partial post-juvenile molt occurred about the last of July when the plumage of the fledgling was changed to that typical of the first-year birds. During this time the birds left the nesting areas and remained in seclusion in dense cattail marshes.

9. After most birds had completed their autumn molt they wandered about the fields in large flocks during the day, and returned to the marshes at night.

10. Migration began about September 1 and by September 17 all Yellow-headed Blackbirds had left the study areas.

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SEASONAL PATTERN AND GENIC BALANCE

BY ERNST SCHWARZ

IN A recent paper (Schwarz, Journ. Heredity, in press, 1941) it was pointed out that in mammals the difference in color and pattern between the normal summer and the normal winter coat is controlled by the genic balance of sex. The shift can be appraised by its effect upon the major pigment factors. It is in a direction which indicates a stronger action of the male principle during the autumn molt. This shift in its effect upon the various pigment factors can be summarized as follows: (1) eumelanin (black extension) = E: increase of black (shift in a dominant direction); (2) recessive white (color) = C: reduction of yellow (shift in a recessive direction); (3) agouti = A: more-distinct banding of the individual hairs; a more distinct demarcation between the upper and the lower sides (shift in a dominant direction). It was maintained that, as the molt occurs at a time of sexual inactivity, without endocrinal activity of the gonads, the genic balance of the tissue was re-established. The shift in the male direction, therefore, was in agreement with a preponderantly male genic balance, to be expected in mammals where the male sex is heterozygous.

If this assumption be true, it was to be expected that in those cases where the female sex is heterozygous, as in birds, the pigment cycle would be reversed, i. e., that the type of winter plumage would more closely approach that of the female, and the summer plumage that of the male. In detail this would mean that in birds the summer plumage should have (1) more black, (2) less red, and (3) the line of demarcation more distinct. The winter plumage should have (1) less black, (2) more red, and (3) a less pronounced line of demarcation between the upper and lower sides of the body. In addition to that, the effect of the sex factor can be more frequently appraised in birds than in mammals, by the phenotype controlled by the factor 'bar' which is well analyzed in the Domestic Fowl; its effect is increased by the male principle, and reduced by the female principle (Lamoreux, Journ. Heredity, 30: 78-80, 1939). In birds it would mean more distinct barring of the feathers in the summer, and a closer approach to the stippled pattern in the winter.

To check this hypothesis I have selected two typical cases in American birds where a definite difference between the summer and the winter plumage is found. The two species used are the Bay-breasted Warbler (*Dendroica castanea*) and the Scarlet Tanager (*Piranga erythromelas*). In *Dendroica castanea* the yellow pigment (phaeome-

lanin) is not an essential part of the pattern, and is best left out of consideration. However, there is a very marked difference in the amount of black between the summer and the winter plumage of the male; in the winter the feathers of the back and neck have hardly any black pattern, but in the summer there is a broad deeply black streak down the shaft, and the neighboring parts of the barb. Also the forehead and the post-ocular stripe are deep black in the summer, but the black is entirely absent in the winter. Moreover, in the winter, the demarcation between the upper and the lower sides is much less distinct than in the summer plumage. All this means that the pattern produced by the eumelanin and the agouti factors is more in the female line in the winter; in fact, there is very little difference between the sexes in the winter plumage. But the phenotype is in the male direction in the summer. This means that the shift of pigmentation during the autumn molt, when it is controlled by the genic balance of sex within the tissue, is in a direction opposite to that found in mammals.

The same opposite effect can be seen in those mammals and birds that turn white in the winter. In mammals the yellow (phaeomelanin) is the first to disappear (Schwarz, 1941, in press). In birds the reduction of pigment begins with the black (eumelanin). In the snowshoe rabbit hairs formed at different stages of the molt show that the white is due to a fading and widening of the pale subterminal band of the individual hair. In the ptarmigan (see also Salomonsen, Vidensk. Meddel. Dansk. Naturhist. Foren., 103: 1-491, 1939), on the contrary, it is the narrow black margin at the tip of the feather which is the first to be suppressed.

The most conspicuous difference between the sexes in *Dendroica castanea*, however, is in the type and variation of the lipochrome. Here two types can be distinguished: (1) chestnut, which is found on the crown, throat, and sides of the male in the summer plumage; (2) yellow, found in the summer and in the winter plumage of the female, pretty well all over the body. In the winter plumage of the male the chestnut lipochrome is almost completely absent; but the yellow lipochrome has been developed instead, in the same measure, and equally arranged, as in the female. A similar seasonal change of lipochromes is found in the Scarlet Tanager where the summer plumage of the male has a scarlet lipochrome; but the winter lipochrome is yellow like that of the female, and in every respect identical with that of the female lipochrome found in *Dendroica castanea*. The color of the young male in both the tanager and the warbler behaves like that of the female and that of the adult male in the winter.

This change of lipochrome with age and season, therefore, is completely in line with the seasonal change of pigment. It is the genic balance of sex which determines the type of lipochrome, as it determines that of pigment, in the absence of endocrinal activity of the gonads. In the two species of birds examined, the two types of lipochrome, the orange and the yellow, may occur together at the same time. In *Dendroica castanea* the male retains some of the chestnut lipochrome on the sides of the body in the winter plumage. On the other hand the female has a greater or lesser amount of it on the vertex and throat in the summer plumage. This means that we have two different factors for lipochromes: (1) the orange controlled by the male, and (2) the yellow controlled by the female; that is, by antagonistic principles.

It has been maintained that lipochromes do not occur in the skin of mammals. But recently it has been shown by spectroscopic analysis that they are present in the skin of man. It is not possible at present, therefore, to say whether in mammals 'male' and 'female' lipochromes occur. But as true carotinoids are known to occur in the liver of mammals, and as they are closely related to the vitamin-A complex, it will be important to find out whether there is a seasonal and age cycle in the carotinoids which can be isolated from mammalian tissue. The importance of such an analysis for an appraisal of the varying requirements of vitamin A connected with season and age, is obvious.

U. S. National Museum
Washington, D. C.

THE JAMES CRAW PORTRAIT OF ALEXANDER WILSON

BY JOHN M. MCWILLIAM AND CASEY A. WOOD

Plate 9

It is not generally known that the Father of American Ornithology, born in Paisley, Scotland, was a poet and illustrator of no mean rank. His 'Poems and Literary Prose' was not, however, published until 1877, more than half a century after his death. Those interested in this phase of Wilson's early career are referred to an informative sketch by George Ord. The present review deals briefly with the subject of his portraiture. Here, again, for a full account of what is known of original paintings of Wilson, their copies and the engravings based upon them we are chiefly indebted to papers by Bayard Christy and Frank L. Burns. The contributions of the latter to the 'Wilson Bulletin' are especially valuable. In this sketch we confine our remarks mainly to the Craw portrait.

In 1924, one of us bought from a Glasgow dealer a picture which we believe to be the earliest (and missing) oil painting of the celebrated Scotch-American ornithologist (1766-1813). It was formerly in the possession of Mr. Patrick Comyn MacGregor of Paisley, Renfrewshire, who collected objects of interest relating to natives of that town. This canvas measures 17 inches in height by 15 inches in width. The gilt frame has every appearance of being the original one. The picture is rather dark from age, and there are two slight tears in it, each about an inch long (see the accompanying photographic reproduction, Plate 9). The portrait is obviously closely related to the engraving of Wilson which forms the frontispiece to Volume 1 of the small four-volume edition of Wilson's 'American Ornithology,' Edinburgh, 1831. The engraving is there legended as "Painted by James Craw, Engraved by W. H. Lizars." There are several minor differences between these pictures. The painting shows five buttons on the breast of the coat, whereas the engraving has four. The painting lacks the curtain that appears on the top left-hand corner of the engraving. The book in the extreme lower-right corner of the engraving has its fore edge in view, while in the painting it is turned the opposite way, with the 'spine' showing. The engraving provides Wilson with a more elaborate inkpot than is given him in the painting. Except for a few slight differences of this nature the two are entirely similar, down to the shape of the ribbon in the hair and the shape of the quill pen in Wilson's hand. The engraving is on the whole a more artistic affair, though it might



PORTRAIT OF ALEXANDER WILSON (1766-1813) BY JAMES CRAW

Photo by James M. McWilliam

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be said that the alert expression on Wilson's face in the engraving is not as pleasing as the rather more serious expression in the painting.

Although we have diligently searched for such information we have not been able to unearth much about the artist, James Craw, nor about his oil portrait of Wilson. The Rev. James Thomson, minister of Mochrum Parish, Wigtownshire, who was formerly a minister in Paisley, took at one time considerable interest in Wilson, and published in 'The Paisley Daily Express,' 18th November, 1925, an interesting biography of Wilson, entitled 'Alexander Wilson, Poet and Ornithologist,' which was later reprinted in pamphlet form. We quote from that pamphlet. "Now for the portraits. To James Craw, of whom nothing was known publicly until I had the good fortune to gain touch with his descendants, we owe it that Wilson's face has been (accurately) preserved for us. Craw was a housepainter and lived in Dyer's Wynd. The date of his birth is unknown. The late eighteenth and the early nineteenth centuries were days of bitter, bad trade, and he enlisted. A pathetic letter from Stirling to his wife bewails his comfortable home and lingers tenderly over a lock of her hair. Poor fellow, in 1794, the year of Wilson's emigration, he was to die in Lower Germany."

"The date of his painting in oil has been given as 1788, when Wilson was 22 years of age." Then follows Mr. Thomson's 'List of Authentic Portraits': (1) Craw's original, (present) location unknown; (2) copy from Craw by Cairns, a local amateur, Paisley Museum; presented by Provost Clark. "Frequently taken for the original. Search in the museum records has resulted as above."

Mr. Thomson also notes (3) a very freely made copy of the Craw portrait by Sir John Watson Gordon. "Sir John apparently copied the head, and invented the birds, gun, etc. [Present] location [of his original copy] unknown." (4) "Engraving by Lizars from the preceding" in the Scottish National Portrait Gallery, and (5) "small photograph in Paisley Museum" which is there recorded as "made from the oil painting in possession of his niece, 1862." This photograph is rather puzzling. It is not, we believe, definitely stated to be from the Craw portrait, and it certainly does not appear to bear a close resemblance to any engraving of that picture. In Mr. Thomson's list there follow descriptions of the other well-known portraits. Practically all that can be deduced from the foregoing is that the location of Craw's original portrait could not be traced in 1925.

About the painting itself, it may confidently be claimed that it has every appearance of being the missing (original) James Craw portrait, or (conceivably) a copy of it made at a very early date, although

the latter conjecture seems very unlikely. The painting is unsigned. It and the frame have the appearance of being as old as the late eighteenth century.

Unless a picture is quite famous or has always remained in the possession of one family it is often difficult or impossible to trace its history or successive owners. A book may have the names of owners marked on or in it, but that is seldom the case with a picture. Cases have been known where an artist made a second version of his portrait, but nothing, so far as we know, has ever been heard of an earlier copy of the Craw portrait than the one in hand by the artist or by any other person. We do not see how at this time the history of this Wilson portrait can ever absolutely be cleared up. Probably it was owned by successive people in Paisley. It may at least be said that it is a very old and possibly the oldest representation of Wilson; that it is obviously very closely related to the well-known engraving by Lizars, and that there is no reason to believe that it is not the *missing* portrait. The fact that it was owned by Mr. P. C. MacGregor is a strong argument for its importance. Not very long after we got possession, it was exhibited at the Royal Physical Society of Edinburgh. One of us recently wrote Mr. Thomson about the whole matter but so far he has been unable to learn anything new on the subject.

Finally, one of us was put in touch with Miss K. A. MacGregor, a niece of the late owner of the portrait, and sent her a photograph of it, asking whether she remembered it, and could tell us anything of its history. She very kindly replied, in January 1940: "I received your letter and regret that I cannot give you any information *re* the enclosed snapshot. The picture belonged to my Uncle, who died, I believe, in 1884. He was Patrick Comyn MacGregor of Brediland."

The foregoing report relates the known history of the Craw portrait for fifty-six years; and it may be presumed that Mr. MacGregor owned it for some time prior to 1884 (possibly eighty years or so ago), which would bring it fairly close to 1831, the year when the engraving was made by Lizars. Thus we have at least its history for one half of the period between 1831 and the present day.

Toward the end of 1940, through the efforts of both of us, the precious Craw painting was acquired by a Canadian repository. It is, at this writing, securely housed "somewhere in Scotland" for the duration of the present war; and there it will remain until it can with safety be transferred to the Wood Library of Ornithology, McGill University, Montreal, where it will be hung for public inspection.

TAXONOMY AND HABITS OF PIGEONS

BY E. W. GIFFORD

THE taxonomic groupings of the species of pigeons and doves are based primarily on structural characters. Classifications differ in the rank assigned to these characters. In the last fifty years the ranking has fluctuated between extremes. Thus, Salvadori (1893) divides the order Columbæ into the suborders Columbæ and Didi. W. L. Sclater (1930) reduces these suborders to family rank, Columbidae and Raphidae. Salvadori recognizes five families within his suborder Columbæ: Treronidae (fruit pigeons), Columbidae ('true' pigeons), Peristeridae ('ground doves'), Gouridae (crowned pigeons), and Didunculidae (tooth-billed pigeon). Sclater, dealing with African birds only, embraces the first three in his family Columbidae, which carries the implication that he must include therein also Salvadori's Gouridae and Didunculidae. He does not even accord Salvadori's families the rank of subfamilies. Peters's (1937) classification follows Sclater's scheme of two families: Raphidae and Columbidae, but divides the latter into four subfamilies: Treroninae, Columbinae, Gourinae, and Didunculinae. Within the Columbinae, Peters's order of listing is virtually that of Salvadori's families Treronidae, Columbidae, Peristeridae, Gouridae, Didunculidae, and I might add, of Salvadori's subfamilies as well. The taxonomic pendulum alternately swinging from lumping to splitting of genera will perhaps in time prove to be a cultural phenomenon of the same order as the alternations in dress fashions (cf. Richardson and Kroeber, 1940).

Best suited for this discussion is the hierarchical grouping set forth by Salvadori. Naturally, I am concerned only with his suborder Columbæ, which he divides into five families: Treronidae, Columbidae, Peristeridae, Gouridae, and Didunculidae. I have never kept members of Gouridae nor of Didunculidae. I have had a few Treronidae, but never bred them. The ensuing remarks concern some of the characteristic actions of the living birds and the extent to which these actions coincide with the taxonomic groupings. On the whole there is some degree of correlation between Salvadori's groupings and the actions of the living birds. The following brief notes on characteristic actions of certain pigeons and doves are based on observations of individuals of a number of species, which the writer has kept as aviary inmates at various times over a considerable number of years.

SUBORDER COLUMBAE

Certain activities of pigeons are well known and serve to distinguish them as one of the best-marked major groups of birds. Such are: (1) feeding the young by regurgitation; (2) drinking by immersing the bill and sucking in the water, often at a single draught; (3) division of incubation duties, males sitting during the day, females during the night; (4) monogamy and mating for life.

A high degree of 'paternal instinct' is manifested in the feeding and care of the young. In some individual pairs, at least, I have observed only the males feeding the young after they have left the nest. Indeed, I have observed female *Chalcophaps indica* and *Oena capensis* fly away from pleading young and leave them to the male parents to feed. Contrariwise, I have seen a hen *Macropygia unchall*, that had laid only infertile eggs, repeatedly feed a young *Tympanis tria tympanistria*. Consequently, what I refer to as 'paternal instinct' is a tendency rather than a hard and fast rule.

The duration of family life in which parents and offspring form a social unit is brief and is usually terminated when the young have molted partially from juvenal into adult plumage. After that, adults and young ignore one another, or the young are driven away when coming too close to the adults. Sometimes the young may drive the parents away. The reciprocal attitude of parents and young becomes that of unrelated birds. While the young are still in juvenal plumage, it is a common thing for them to perch with the parents, often between the parents. Frequently the parents show marked solicitude, preening the squabs' head-feathers, just as they frequently do one another's. Sometimes doves of other species show similar interest in strange squabs.

In an aviary with permanent boxes for nesting, recognition and defense of property rights prevail during nesting only. Once the young leave the nest, the parents cease to drive intruders from its vicinity.

Most doves and pigeons that I have kept are enthusiastic bathers, especially when first rains come after a long dry spell. They lie on the side with one wing raised, so as to allow the drops to strike under the wing. They will do the same thing when spray is supplied with a hose. They are equally ardent sun-bathers, lying belly down with tail and one wing spread against the ground, or lying on the side with the upper wing partly spread.

Duration of incubation is somewhat variable. For the family Gouridae it is four weeks, for the subfamily Caloenadinae it is

three weeks, for the genus *Columba* about sixteen days, for the Peristeridae two weeks.

FAMILY TRERONIDAE

To live indefinitely in captivity, fruit pigeons require soft food. They can be induced to partake of seed by mixing it with the soft food and gradually increasing the quantity until they are entirely on a seed diet. On such a seed diet, however, they do not thrive and usually die after a year or two.

One of their most conspicuous characteristics is grasping with the toes; some species are almost parrot-like in their ability to hold themselves upside down or in a vertical position, whence the German characterization of Papagei-tauben. Grasping with the toes is also a characteristic of squabs of all species of the families Columbidae and Peristeridae and is particularly manifested when one lifts a squab from a nest. It would seem almost that this is an infantile pigeon characteristic that is held over in adult life in the family Treronidae.

FAMILY COLUMBIDAE

Subfamily Columbinae.—Next to the Treronidae, these pigeons grasp with their toes to greatest extent and are most arboreal or perching in their habits. There seems insufficient differentiation in the habits of the various species of *Columba* to warrant elevating the several subgenera to generic rank as was done by Ridgway (1916).

All Columbinae which I have kept partook of seed readily.

Subfamily Macropygiinae.—Experience with this subfamily is limited to three species: *Macropygia unchall*, *M. tenuirostris*, and *M. rufa*. They are very long-tailed, short-legged birds, which, in their preference for perching, substantiate Salvadori's placing them next to the Columbinae, rather than next to the genus *Geopelia* of the family Peristeridae, where Baker (1913, 3: 237, 252) puts them.

On the ground they are clumsy, for their short legs and long tails militate against an easy gait. Often the long tail is carried slightly elevated, apparently to avoid dragging on the ground. In cooing to the hen, the cock expands his crop region extensively so that it touches the ground. He bows slightly, raises and lowers the front of his body slowly. His tail is kept horizontal and slightly spread. Their actions suggest that they belong with the Columbidae rather than with the Peristeridae.

FAMILY PERISTERIDAE

The wide variation in behavior in this family seems to warrant grouping into subfamilies, although within certain of these the behavior is not so uniform as might be expected. All that I am acquainted with feed one another just prior to coition.

Subfamily Zenaidinae.—This American group is quite homogeneous. The males of the species that I have kept make conspicuous display of the iridescent neck and crop regions when cooing. The expansion of these parts gives prominence to the brilliant coloring.

Subfamily Turturinae.—This Old World group is another homogeneous one in habits. In paying his addresses to the hen, the cock points his bill somewhat downward, expands his throat, and bows rapidly and repeatedly, sometimes taking a few steps toward her if she moves away. The tail is only slightly expanded if at all, and is not elevated above the normal level.

Subfamily Geopeliinae.—The genus *Geopelia* is Asiatic, Malaysian, and Australian in distribution, while *Scardafella* is American.

Gymnopelia erythrothorax, the single species of a monotypic genus, put by Salvadori in this subfamily, has been placed now in the genus *Metriopelia* under the name of *Metriopelia ceciliae* (Peters, 3: 102). That it does not belong in the subfamily Geopeliinae is apparent from its short tail and different behavior. That it belongs with the other *Metriopeliae* from the standpoint of habits, I am unprepared to say, as I have never kept other *Metriopeliae*. In appearance and actions *Gymnopelia erythrothorax* is very different from *Geopelia* and *Scardafella*. It runs as rapidly as a quail on the ground, suggesting *Lophophaps* in this respect. In cooing it does not spread and elevate the tail to a nearly vertical position as do the *Geopeliae*. (Incidentally, *Stictopelia cuneata* certainly agrees with the genus *Geopelia* in this respect.) In perching and cooing *Gymnopelia* raises and lowers the tail slightly without spreading it. Indeed, in the mating season it keeps its tail in motion like a pipit. In doing this the tail is not moved far from a horizontal position. This behavior is different from anything I have seen in *Geopelia*. I think its removal from Geopeliinae is warranted on the basis of actions. Except for *humeralis* which has a cuckoo-like call, the species of *Geopelia* have a croaking, more or less frog-like *coo*.

Subfamily Peristerinae.—This American group comprises several genera, of which I have experience only with *Chamaepelia* (*Columbigallina*), *Claravis*, and the afore-mentioned *Metriopelia ceciliae*.

Chamaepeliae have one very characteristic action, the rapid twitching of one wing by the male, when he is paying his address to the hen.

This takes place either when sitting on a perch beside her or when cooing to her. This is least noticeable in *C. cruziana*, but very characteristic of *C. passerina*, *C. minuta*, and *C. talpacoti*. *C. cruziana* has at times been placed in a monotypic genus, *Eupelia* (Ridgway, 1916: 282). Unlike other *Chamaepeliae*, it has a call that is so like the croaking of a frog as to be mistaken for such if the bird is not visible.

Claravis pretiosa has two noticeably distinctive acts. When alighting, the head is darted forward, then quickly pulled back to normal position. In cooing to the hen, the cock lifts his feet very high and puts them down slowly.

Subfamily Phabinae.—This Old World group is African, Asiatic, Malaysian, and Australian in distribution. It is divided taxonomically into two groups, distinguished by presence or absence of a pair of dark transverse bars on the rump. In the first are the African genera *Oena*, *Tympanistria*, and *Chalcopelia* (now *Turtur*), and the Asiatic-Australian genus *Chalcophaps*. From the standpoint of actions these should be distinct genera without a doubt.

Oena capensis is a very long-tailed dove, quite butterfly-like in its aerial activities, one of which is a hovering, descending flight with tail spread on the part of the male when disporting before the female. When alighting, both sexes raise and lower the tail. In cooing to the hen, the cock lowers his head, elevates his tail without spreading it, and moves both wings slightly and rhythmically at the rate of about one hundred times a minute.

Tympanistria tympanistria, the Tambourine Dove, is rightly named for its call, which is produced while the male stands perfectly still with the sides of the throat much expanded and palpitating rhythmically as he pipes his call. Sometimes, in displaying to the hen, the cock elevates his unspreed tail slightly. There is no bowing motion as with the *Turturinae*.

Chalcophaps is as distinctive as *Oena* in its mating activities. The display of the cock to the hen can best be described as a ridiculously slow jumping-jack movement in which the cock raises and lowers himself vertically several times beside the hen before mounting her.

Of the second division of the *Phabinae*, I have kept only *Phaps*, *Lophophaps*, *Ocyphaps*, *Geophaps*, and *Henicophaps*. Unfortunately the last was represented by females only.

The two species of *Phaps* have a very brilliant display, the male spreading wings and tail in a partially vertical position, so that the iridescent coloring on the wings shows to advantage. At the same

time he makes a sort of waddling motion from side to side or he may take a few jumping steps forward toward the hen. Similarity of activities justifies placing these two species in one genus, rather than in two as Mathews (1913: 18) has done.

Monotypic *Ocyphaps* and *Lophophaps*, the latter solely terrestrial in habits and a very fast runner, both have a rapid, dancing, jumping-jack mating display with tail elevated and spread against the partially opened wings, resulting in the iridescent speculum of the wings showing brightly. This 'dance' is much more rapid than the slow jumping-jack movement of *Chalcophaps*. It is accompanied by a marked brightening of the iris. In flying, *Ocyphaps* has whistling wings, and flips its tail up, then down, when alighting.

Subfamily Geotrygoninae.—Quail-dove and Partridge Pigeon are terms which correctly express the galline appearance of these birds with their long legs, short tail, striding gait, and bobbing tails. *Otidiphaps* is quite pheasant-like in walk and actions; the others are quail-like.

When frightened, *Geotrygon*, *Phlogoenas* (except *Terricolumba*), and *Leucosarcia* have the habit of putting the breast against the ground, often in a corner and elevating the tail so high that the under tail-coverts are toward the observer. The group of *Phlogoenas* or *Gallicolumba*, which Hachisuka (1931) has separated as the new genus *Terricolumba*, lacks this habit. However, it possesses distinctive positive habits, viz., a barking call and a disheveled, loose-winged appearance when courting or fighting. It would seem that the separation is made on good grounds so far as habits are concerned.

Hachisuka's delimited genus *Gallicolumba* (formerly part of *Phlogoenas*) embraces the so-called Bleeding-hearts (*G. luzonica*, *G. crinigera*, *G. rufigula*, etc.), birds that are characterized by a carmine, orange, or yellow patch in the center of the breast. Besides the tail-elevation when frightened, other very distinctive acts of these birds are: nodding while walking, and throwing the head back and expanding the breast when cooing, so that the colored spot shows to greatest advantage, an act apparently comparable in purpose to the wing-spreading in *Phaps*, *Ocyphaps*, and *Lophophaps* to display the speculum and iridescence.

I have observed in both *Geotrygon montana* and *Gallicolumba rufigula* the habit of raising both wings high above the back while standing, or while sitting in the nest. This is part of the courtship, males doing it more frequently and raising the wings higher than females. It is done when the mates are apart. Another habit of these two species, and probably of others of these genera, is stamp-

ing hard on the ground by the males when courting. This is evidently analogous to the high stepping of *Claravis pretiosa* mentioned above.

Starnoenas has the curious habit of stopping short with head up when walking, then in a few seconds gradually lowering the head and resuming its walk.

Mealworms and earthworms are especially relished by *Gallinolumba*, *Geotrygon*, *Starnoenas*, and *Otidiphaps*. Also my *Phaps chalcoptera* hunt earthworms whenever damp ground is spaded for them. One day I observed a male *Geotrygon montana* attempting to swallow a newly hatched but dead *Chamaepelia squab* which lay on the ground. Evidently animal food must form a considerable part of the diets of the *Geotrygoninae* in their native habitats.

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University of California
Berkeley, California

VARIATION IN NORTH AMERICAN RAVENS

BY GEORGE WILLETT

DURING several years past the writer has given considerable time to the study of the Raven (*Corvus corax*) as it occurs in North America. This work was undertaken in an effort to ascertain the number of geographical races and the limits of their ranges. Summation of the facts brought to light has been delayed in the hope that additional material from pertinent localities might be secured, but, as it seems unlikely that this hope will be realized in the very near future, it may be advisable to publish a short account of what has been learned, so that it may be available to other students in this field.

There are at least three factors that make the recognition of different races in *C. corax* difficult. First, because of sameness in color, only variability in size and proportion is useful in separating races. Second, individual variation in size in birds of the same region is so great that even a fairly large series of specimens obtained at random may be misleading. Third, we have little knowledge regarding migratory movements in the species, so that it is unsafe to assume that birds taken outside the breeding season are members of the breeding population where they are secured.

It has apparently been the custom of some authors to combine measurements secured from specimens of both adult and immature ravens, a method that is sure to result in erroneous conclusions. A bird may have assumed most of its adult plumage and still not have attained full size. All the birds used in this study are believed to be adult, having been separated from immatures by the shape of the tail-feathers. This selection resulted in decreasing greatly the number of specimens available for use, as it was found that most collections contain a large proportion of immature birds. A total of 120 specimens of adult birds has been used, admittedly far too few for satisfactory solution of some of the more complex problems involved. Gratitude is expressed to the following institutions and collectors for use of their specimens: Colorado Museum of Natural History, Donald R. Dickey Collection, Hancock Foundation, Los Angeles Museum, Museum of Vertebrate Zoology, Museum of Zoology (Ann Arbor), San Diego Natural History Museum, Louis B. Bishop, Ed. N. Harrison, Stanley G. Jewett, Robert T. Moore, J. R. Pemberton, Kenneth E. Stager and John G. Tyler.

Measurements used throughout this study, and believed to be the most important ones, are wing, culmen (from frontal feathers to tip), and depth of bill at nostril. Also, a character that appears good in differentiating between northern and southern birds is depth of tarsus (front to back) at its middle.

Results of computation of average measurements of various series of birds used here appear to indicate a large race (*principalis*), with heavy bill and tarsus, in Alaska and British Columbia; another large race (*sinuatus*), with slender bill and tarsus, in the Rocky Mountains and Great Basin region; and a small race (*clarionensis*) ranging from interior valleys of California to Clarion Island, Mexico. There seem to be intergradational areas between the two large races in northwestern United States, and in northeastern United States and Canada, and between large and small races in southeastern California and to a lesser extent on the islands off southern and Lower California and on the peninsula of Lower California itself. An examination of birds from these three last localities shows an extreme individual variation not found in specimens from any other region. No specimens of eastern birds from the southern part of the range of *C. corax* have been available, consequently nothing regarding their racial identity can be said here.

Following are *average* measurements in millimeters of series of specimens to be discussed (cul. = culmen from frontal feathers; d. b. = depth of bill at nostril; d. t. = tarsus from front to back at middle).

ALASKA AND BRITISH COLUMBIA (*C. c. principalis*)

8 males: wing, 438; cul., 77.45; d. b., 28; d. t., 11.5

4 females: wing, 433; cul., 73.7; d. b., 27.4; d. t., 11.2

ROCKY MOUNTAINS AND GREAT BASIN (*C. c. sinuatus*)

14 males: wing, 439; cul., 74.2; d. b., 24.3; d. t., 10.2

10 females: wing, 425; cul., 69.7; d. b., 23.4; d. t., 9.8

SAN JOAQUIN VALLEY, CALIFORNIA (1 male from Sacramento Valley)

7 males: wing, 403; cul., 66.5; d. b., 22.5

5 females: wing, 407; cul., 66.6; d. b., 21.7

SOUTHWESTERN CALIFORNIA

1 male: wing, 410; cul., 69; d. b., 22.6

2 females: wing, 399; cul., 66.6; d. b., 21.4

CLARION ISLAND (*C. c. clarionensis*)

6 males: wing, 410; cul., 71.8; d. b., 23.4

11 females: wing, 391; cul., 68.1; d. b., 22.3

ISLANDS OFF SOUTHERN AND LOWER CALIFORNIA

8 males: wing, 421; cul., 70.5; d. b., 23.9
12 females: wing, 404; cul., 67.3; d. b., 22.8

PENINSULA OF LOWER CALIFORNIA

12 males: wing, 421; cul., 69.7; d. b., 23.6
7 females: wing, 417; cul., 66.9; d. b., 22.5

From the first two lots of measurements it will be noted that the only substantial size differences between *principalis* and *sinuatus* are in depth of bill and depth of tarsus. Although the culmen in our northern birds averages longer, there is much overlapping in this character. A male and two females (D. R. Dickey Coll.) from Salvador have longer wings than the average Alaskan specimens, but the bills are more slender, averaging 25 millimeters in depth. Three males from New Brunswick (L. B. Bishop Coll.) average: wing, 431; cul., 74.9; d. b., 26.1. These birds (*euophilus* Oberholser) appear to be intergrades between *principalis* and *sinuatus*, somewhat nearer the former.

As preceding lists of measurements show, birds from the interior valleys of California and the Pacific slope of the southern part of that State are of about the same size as specimens from Clarion Island, Mexico (*clarionensis*), although bills of the Californian birds appear slightly smaller. Examples from territory intervening between southwestern California and Clarion Island average nearer to *clarionensis* than to *sinuatus*, though measurements of wing and depth of bill may indicate an approach toward the latter. Among twelve males from Lower California there is not a single specimen as large as average *sinuatus*, and in seven females, just one bird (El Rosario, San Diego Soc. Nat. Hist.), with measurements of 430, 70.4, 23.6, reaches that average. None of the twenty birds from islands off southern and Lower California is as large as average *sinuatus*. In the last two lots, however, seven birds out of 39 examined reach the minimum of *sinuatus*, and, if taken in the Rocky Mountain region, would undoubtedly be referred to that form without question. In this connection, it may be worthy of record that the two largest of the above seven birds are from the more northern islands of Santa Cruz and San Nicolas, and that both were taken during the winter months.

From the limited material at hand it is obviously impossible to tell how far down the coast the influence of *principalis* may extend. Two males, one from Marin County and the other from Mendocino County, California, average 422, 69 and 24.7 millimeters, a shorter wing than is found in any of our Rocky Mountain specimens and

with proportionately thicker bill, just about what might be expected in intergrades between *principalis* and *clarionensis*. Specimens of ravens from the coastal region of central California are apparently rare or absent in collections, consequently it has not been possible to determine how far north along our coast the smaller bird extends. One male example (Mus. Vert. Zool.) from Red Bluff, Sacramento Valley, measures 405, 66, 21.5 millimeters, which would appear to place it definitely with the small, southwestern bird.

Among seven birds from the California deserts, a region where intergradation between the small coastal birds and larger montane ones would be expected, are two males (Mojave and Riverside Mt.) that are typical *sinuatus*, one female (Mecca) close to typical *clarionensis*, and four variously intermediate between the two.

These facts appear to indicate that the ravens of the southwestern coastal district of the United States and the west coast of Mexico are smaller than *Corvus corax sinuatus* of the Rocky Mountain and Great Basin regions, and that they are not satisfactorily distinguishable from the bird of Clarion Island, Mexico, which has been called *C. c. clarionensis*. However, the series of specimens examined is admittedly small, perhaps inadequate, for study of a species that exhibits so much individual variation. The decision as to whether sufficient evidence has been presented here to call for inclusion of *Corvus corax clarionensis* in the A. O. U. 'Check-list' is left entirely to the Committee preparing that list. One recommendation is ventured, however, that if *clarionensis* is included, its vernacular name be 'Southwestern Raven,' rather than 'Clarion Island Raven,' so avoiding another addition to the present list of misnomers such as Farallon Rail, California Creeper and White-cheeked Goose.

Los Angeles Museum

Los Angeles, California

A NEW RACE OF *CORACINA CALEDONICA*

BY E. MAYR AND S. DILLON RIPLEY

THE species, *Coracina caledonica*, found in Melanesia from New Caledonia to the northern Solomons, occupies a rather isolated position with no close relatives on the neighboring islands. Previously the birds from the Solomon Islands were included in a separate species, *welchmani*. Specimens of *C. caledonica* from New Caledonia when compared with any one of the three races from the Solomons show a good deal of difference in the lack of any pronounced sexual dimorphism. Both the males and the females of *caledonica* are similarly colored, whereas in *bougainvillei*, for example, the crown, lores, chin, and throat of the male are glossy black while the female has black only on the auricular area. Comparison of birds from the Loyalty and New Hebrides Islands has shown, however, that there is a gradation or cline from one form of coloration into the other. This condition is also paralleled by the slight differences in bill and tarsus which intergrade from island to island.

Our study of these forms has disclosed that birds from Erromango Island belong to an undescribed race. We therefore propose:

Coracina caledonica seiuncta new subspecies

Type.—No. 305836, American Museum of Natural History, adult female, from Erromango Island, southern New Hebrides; collected May 1, 1936, by L. Macmillan.

Subspecific characters.—Differs from *lifuensis* by being smaller; color of upper and under parts much lighter and paler, between slate and slate-gray; under wing-coverts paler, almost whitish gray; under tail-coverts slate. From *thilenii* of the northern New Hebrides, this race differs by being smaller; less blackish on the throat and malar region; under wing-coverts paler, less blackish slate-colored; under tail-coverts slate rather than blackish.

The adult female differs as the male except that the female of *thilenii* has the throat and malar region slaty as in *seiuncta*. One immature bird shows the same subspecific characters.

Culmen (of molting adult male specimen), 27 mm.; tarsus, 33; wing (one female adult), 181; tail, 157.

Range.—Erromango Island, southern New Hebrides Islands.

This very distinct race occupies a curiously isolated position; no other populations of this genus have been found on the large islands immediately to the north or south of Erromango.

American Museum of Natural History
New York City

GENERAL NOTES

Cory's Shearwater in South Carolina.—On August 18, 1940, one week after a tropical hurricane had hit coastal South Carolina, the badly decomposed remains of a large shearwater were found by Dingle on the Isle of Palms, eight miles east-northeast of Charleston. The yellow bill attracted immediate attention. Because of a certain amount of white on the inner webs of the primaries, the writers were inclined to consider the bird *Puffinus diomedea diomedea*. However, being handicapped by a lack of comparative material, we sent the specimen to Dr. Alexander Wetmore for final determination. Dr. Wetmore has advised that the bird is Cory's Shearwater, *P. d. borealis*, "the form ordinarily to be expected on the eastern coast of the United States." As far as we know, this constitutes the first definite record for South Carolina.

At this time it may be mentioned that we know of no specimen of the Greater Shearwater, *Puffinus gravis*, from this State. The late Arthur T. Wayne, in 'Birds of South Carolina' (1910: 8), states that the cyclone of 1893 destroyed great numbers of these birds, and that a few days after the storm the Long Island (Isle of Palms) beach was "literally strewn with dead birds." Examination of Mr. Wayne's record book of specimens collected during August and September of 1893 fails to disclose any record of a shearwater collected or prepared during that period. Our files contain later sight records, by other observers, and we now believe that these records may apply as well to Cory's Shearwater as to the Greater. One record in our files is based on a badly decomposed specimen found after the 1911 storm. In the 'Bulletin' of the Charleston Museum (7: 50, 1911), L. M. Bragg records this specimen as *Puffinus gravis*, "the head and bill being unmistakably that of a shearwater, and the white feathers of the throat and breast distinguishing it from the only other large shearwater found along our coast, the Sooty Shearwater (*Puffinus griseus*)." No mention is made of the color of the bill of this specimen and it is possible that the bird may have been Cory's Shearwater.—EDWARD S. DINGLE and E. B. CHAMBERLAIN, *The Charleston Museum, Charleston, South Carolina*.

Gannets along the Connecticut River in New Hampshire and Vermont.—On October 24, 1940, an immature Gannet, *Moris bassana*, landed on a tennis court on the campus of Dartmouth College, at Hanover, New Hampshire. The bird was in an exhausted condition when picked up by Professor Lauren M. Sadler and brought to me. We fed it on a diet of fish scraps until it was strong enough to be released. On October 27 it was given the U. S. Biological Survey band no. 37-715727 and placed on Occum Pond near the campus. It remained on and around the pond until November 2 when it disappeared. It was able to fly from one end of the pond to the other and readily came to the shore for food. On November 5, it was turned in to the Vermont Fish and Game Service and thence returned to me via James Otis and George Davis. It had been shot at North Hartland, Vermont, which is twelve miles south of Hanover along the Connecticut River. The bird had landed in a field with a flock of turkeys. The second Gannet, which was also an immature bird, landed in an exhausted condition at Barnet, Vermont, also along the Connecticut River, fifty miles north of Hanover. This bird was found October 23 and was kept alive for eleven days on a diet of 'hamburger'. When it finally died it was also sent to the Vermont Fish and Game Service and thence to me. This specimen will be returned to the Service for use in their study collection, while the Hanover bird will be placed in the Dartmouth College Museum.

Several other records of this bird have been made in the Connecticut Valley in New Hampshire and Vermont. One was found at Jefferson, New Hampshire, October 13, 1910, and another at East Corinth, Vermont, October 9, 1938.—RICHARD WEAVER, Dartmouth College, Hanover, New Hampshire.

Snowy Egret again nesting in Cape May County, New Jersey.—In 'The Auk' for January 1940, McDonald, Daly, and Gillespie reported the first nest of the Snowy Egret, *Egretta thula thula*, in New Jersey since about 1886. This nest was found "in Cape May County, New Jersey," on July 9, 1939. It is a pleasure to report a 1940 breeding record for the same species in the same vague location (correspondence with last year's discoverers discloses that the site is identical; hence the birds may be the same pair).

On May 30, 1940, the writer, accompanied by Malcolm S. Ferguson and Richard A. McLean, discovered a nest of the Snowy Egret in the above situation. It contained one egg, and reposed in a cedar tree about eight feet from the ground. Numerous Black-crowned Night Herons' nests in the vicinity contained eggs also, but a few harbored newly hatched young. Three adult Snowy Egrets were observed in the colony. No Little Blue Herons could be found. Ownership of the nest was established by retiring some distance to observe the adults, two of which promptly flew to the tree in which the alleged Snowy Egret nest reposed. A Black-crowned Night Heron's nest was in the same tree, about two feet above the egret's nest. Direct comparison of the Night Heron's eggs with the single egret's egg was possible, and the difference in size was readily discerned.

On June 18, 1940, another visit was made to the colony. The Night Herons were a third to a half grown. The egret's nest contained six eggs, which represents the maximum clutch for this species according to Bent's 'Life Histories of North American Marsh Birds.' Only one adult Snowy Egret was seen. It sat in a nearby tree and, when flushed, made only a narrow circle to alight in another tree close by. On July 8, 1940, the nest contained four young birds, evenly graded in size. No trace of the last two eggs was found. The smallest bird stayed in the nest, but the three others tried to clamber away among the cedar branches. All were caught and banded. The tips of their outer primaries had not yet sprouted from their sheaths but were pinkish white—not dark—in color, thus excluding the Little Blue Heron at once as parent to these fledglings.

On this occasion two adult Snowy Egrets were observed. One alit in a neighboring tree while the young were being banded. Periodically it uttered a single harsh note of protest. Later, when the young were returned safely to the nest and we investigated other parts of the colony, it joined its mate in soaring high over the marsh. The day was clear and the birds were seen sharply enough through a binocular against a blue sky for me to state that neither one bore a band on its leg. Last year two young birds were banded.

The young Black-crowned Night Herons were almost all fully fledged at this time and the colony was virtually deserted by this species. Young Fish Crows were flopping about, just out of the nest, while seven or eight Osprey families had just begun their chick phase. No Little Blue Herons or American Egrets were seen, but a single Yellow-crowned Night Heron showed itself for a moment before making a shy exit behind an adjacent 'island' in the marsh.

The Snowy Egret, American Egret, and Little Blue Heron all nested—or are supposed to have nested—in New Jersey during the nineteenth century, the latest records being some time in the '80's. Their lowest ebb, when they were rare even

in Florida, was from 1902 to 1908. As they began to increase in numbers, they gradually reclaimed their original breeding territories. All three reached New Jersey as breeding species within about a decade, showing that the rate of increase under protection was closely parallel. The American Egret was found nesting in Salem County, New Jersey, in 1928, at a time when Snowy Egrets were still extreme rarities—even as visitors—in the State. The Little Blue Heron was found nesting in Camden County, New Jersey, in 1935. The Snowy Egret was found nesting in Cape May County, New Jersey, in 1939. Since the original nests of American Egret and Little Blue Heron were found, both of these species have established themselves in other colonies scattered through southern New Jersey, the number of pairs breeding annually in the State showing a satisfying increase year by year. Sight records of the Snowy Egret have simultaneously become more frequent. It is therefore to be expected that the Snowy Egret will likewise continue to invade this ancient territory, so that in a few years numerous breeding colonies may be familiar to many ornithologists.—C. BROOKE WORTH, *Rockefeller Institute for Medical Research, Princeton, New Jersey.*

American Bittern eats garter snake.—On August 22, 1940, 11.45 a. m., an American Bittern, *Botaurus lentiginosus*, was observed in the shore water of Lincoln Pond on the Edmund Niles Huyck Preserve, Rensselaerville, Albany County, New York. The bittern was standing in two inches of water among a shore zone of *Glyceria borealis* with an approximately 12-inch-long garter snake, *Thamnophis sirtalis sirtalis*, in its bill. The writer approached to within ten feet of the bird without frightening it, and was later joined by three other observers; the addition of these caused the bird (still secreting itself in the *Glyceria*), to move fifteen feet away.

When the bittern was first seen it was holding the garter snake by the center of the body. The bird made four efforts to take the snake's head into its mouth, succeeding on the fourth attempt. The snake's head was then directed down the esophagus, with the body following, by a series of gulping movements. As the head disappeared down the bird's throat the gulping movements were transferred to the esophageal region of the neck, and later to the gizzard region after the tail had entered the bittern's bill. The swallowing process consumed about three minutes. The bittern then raised its bill in the air and held it in this position for a few seconds; lowering its bill, the bird thrust it between the right wing-feathers several times and retired to the shelter of the alders bordering the shore.

At this time of year the garter snakes come down to the shore to feed on newly transformed green frogs, *Rana clamitans*, and bullfrogs, *Rana catesbiana*. The garter snake in search of such food along the shore of Lincoln Pond apparently becomes easy prey for the voracious bittern.—WILLIAM MARCUS INGRAM, *Edmund Niles Huyck Preserve, Rensselaerville, New York and Zoology Laboratory, Cornell University, Ithaca, New York.*

Migrant ducks in the Dominican Republic.—Mr. Hugh A. Johnston, resident for years near Monte Cristi in the northwestern part of the Dominican Republic, has written me recently that migratory ducks have come to his region in great abundance during the last two winters. He reports flocks of many thousands flying over the Rio Yaque del Norte, ten miles above Monte Cristi, attracted apparently by the rice fields located on a government irrigation project.

Among them he found the American Pintail (*Dafila acuta tzitzihua*) common, a species that has not been reported before with certainty from the island. Mr. Johnston has had individuals in captivity from specimens trapped by natives so

that there is no doubt about their identity, particularly since he has kept regularly the Bahama Pintail, the only species with which it might be confused. He also reports shooting the American Widgeon (*Mareca americana*) at the mouth of the Rio Yaque del Norte, another first record for Hispaniola.—ALEXANDER WETMORE, U. S. National Museum, Washington, D. C.

Turkey Buzzards killing young pigs.—It is commonly assumed that the Turkey Buzzard (*Cathartes aura septentrionalis*), through inability to kill its prey, is a scavenger by necessity. Pearson (Bird-lore, 21: 319-322, 1919) speaks of this bird killing young pigs, but gives no specific instance.

During March 1939, at Half Way Lodge, fifteen miles east of Fort Myers, Florida, Mr. Dwight Dyess witnessed buzzards successfully attacking and killing young pigs. Several new-born litters were destroyed by these birds. On one occasion, the birds boldly approached the young shortly after the sow had farrowed them, and tore at the umbilical cord and belly, disembowelling the little pigs. Although the sow was but a few feet off, she offered no resistance other than a few passive grunts. Mr. Dyess assured me that this was not an uncommon occurrence, and that many young pigs were lost each year through the depredations of buzzards.—W. J. HAMILTON, JR., Cornell University, Ithaca, New York.

Gyr Falcon in Wisconsin.—An immature female gray-phase Gyr Falcon (*Falco rusticolus*) was killed on the London Marsh at the western edge of Jefferson County, Wisconsin, just east of the town of London, on December 10, 1939, by Mr. R. R. Roehl of the nearby town of Lake Mills. The bird was examined by the writer shortly after it was mounted by a local taxidermist. The carcass was procured and the sex determined. The stomach was empty. Since the Gyr Falcon is protected by law in Wisconsin, and since it was deemed desirable to preserve this rare specimen, the bird was confiscated by the Wisconsin Department of Conservation, and is now on display in their museum at the State Game and Fur Farm at Poynette, Wisconsin.

In the event that future taxonomic workers in this group may be unable to examine the specimen, the following description is given: upper parts light gray-brown, general tone of head and nape much lighter in color than back, wings, or tail; head evenly and narrowly streaked with light gray-brown and white, 'moustache' mark scarcely discernible; feathers of back light gray-brown, narrowly bordered with white; tail light gray-brown, irregularly and narrowly bordered with white; under parts white, prominently, but not heavily streaked with gray-brown; under tail-coverts white, each feather very lightly marked centrally with a light gray-brown streak; tarsal feathering white to pale buff, unmarked; cere, eyelids, and feet light blue-gray.

Gyrfalcons have been taken in Wisconsin at least four times previously: near Lake Winnebago at an early date, near Beaver Dam on November 27, 1904, in Sauk County on October 22, 1916, and in Milwaukee on December 26, 1939, as reported respectively by Kumlien and Hollister (Bull. Wisconsin Nat. Hist. Soc., 2: [= 3] 1-143, 1903), Snyder (Auk, 22: 413, 1905), Stoddard (Auk, 40: 325, 1923), and Gromme (Auk, 55: 273, 1938).—C. T. BLACK, Game Division, Department of Conservation, Lansing, Michigan.

Marsh Hawk feeding on Scaup Duck.—On November 25, 1939, at Melbourne, Florida, I saw a female Marsh Hawk (*Circus hudsonius*) on the shore of Indian River, feeding on the partly immersed and still fresh body of a Scaup. When first

discovered the hawk was eating the head of the carcass. Later, after vigorous effort, it succeeded in dragging its find from the water. The manifest difficulty of the task made it seem unlikely that it could have captured and killed even a sick or injured duck. Similarly, the length of time, after the breast was plucked, required to open the body cavity indicated something less than the power of beak usually attributed to birds of prey of the size of this species. It is known, of course, that the Marsh Hawk's food consists chiefly of small, soft-bodied animals. As much would be deduced from the observation here recorded and the conclusion is reached that the finding of remains of wildfowl or poultry among the stomach contents of hawks is doubtful proof of their danger to these forms.—EDWARD R. FORD, *Chicago Academy of Sciences, Chicago, Illinois.*

Sage Hen eats grasshoppers.—During the past summer (1940) I noticed Sage Hens, *Centrocercus urophasianus*, feeding along the roadway in central Montana, sometimes at a distance from their usual feeding environment of sagebrush. I have often wondered if they were feeding on grasshoppers, but not having a collecting permit I was unable to obtain any birds for a food-habit determination.

On August 6, while at Yellow Water Reservoir south of Winnett, Montana, in the company of Philip Van Cleave and Allen Erickson, I found the remains of a Sage Hen. The body, including all of the bones, had been eaten or carried away. The feathers, however, provided adequate identification and luckily, the modified gizzard was intact. A pile of 19 grasshoppers from the gullet indicated what the bird had been eating. The gizzard was analyzed to determine to what extent this bird had been feeding on 'hoppers. It was found that the entire contents consisted of grasshoppers. Some, of course, were in a very much broken and mashed condition; however, the jumping legs served to indicate the number of 'hoppers consumed. There were 150 jumping legs, indicating the consumption of at least 75 'hoppers. These, plus the 19 that were found in the gullet, made a total of 94 grasshoppers destroyed by the Sage Hen just previous to its death. This is but a small part of the number of grasshoppers the bird might consume during the entire day, and indicated that the Sage Hen does, under some conditions, feed exclusively upon grasshoppers.—LOUIS M. MOOS, *Biologist, Soil Conservation Service, Billings, Montana.*

Golden Plover in central Indiana.—Following heavy rainfall in April 1940, many fields in the adjacent flat countryside became temporarily flooded, and numerous shallow lakes were formed. It had stopped raining April 21 and become bright and clear. That afternoon we were driving along an unfrequented country road beside a last year's cornfield which was partly inundated, when we saw a flash of wings about a hundred yards distant from us on the opposite side of the water.

We stopped our car, and training our binoculars in the direction where we had seen the birds flying, were surprised to see a considerable number of Golden Plover (*Pluvialis dominica*) feeding along the edge of the water, and in the field near the water. The whistled call note was unmistakable, as were the golden-brown back, white streak above the eye and along the sides of the breast, and black throat and breast. The male birds were more strikingly marked than the females, and a number of the males performed energetically. Whistling, with wings slightly lifted, and head lowered, a male would run toward a female, stop when almost touching her, then run off again and come back and repeat the performance. Several times males had brief fights. Two of them became so embroiled that they carried their quarrel from land to water. They were going at one another

so vigorously that nothing but deep water, which finally made both fly, separated them.

We did not leave our car, and several times birds came within fifteen or twenty feet of us. Twice cars passed, and we moved our own also, but the birds were not in the least disturbed. We found that the birds were on both sides of the lake, which was over a hundred feet wide and three hundred feet long. Several times, all the birds flew, and after the flock circled about over the water for a moment, alighted again, some near to us and others on the opposite side of the water. They all immediately began to run about, usually quite independently of each other and started to feed again.

There were at least a hundred plover in the flock. We also noted several Lesser Yellow-legs, and one Greater Yellow-legs, which mingled freely with the plovers, even joining them in their circling flight over the water.

After we had been watching the birds for about an hour, they finally all flew some distance to the extreme far side of the field.—DELOS E. JOHNSON, 42 Public Square, Shelbyville, Indiana.

An oddly colored Wilson's Snipe.—A peculiarly colored specimen of Wilson's Snipe (*Capella delicata*), was collected November 25, 1937, about one mile north of the Savannah River, in Beaufort County, South Carolina. This bird, a female, did not differ greatly from the ordinary in size, or in the color of the soft parts, but the plumage seemed to lack one of the color elements of the normal bird. This gave it the appearance of a buffy bird, rather than a blackish one. The buffy tone was carried out completely over the plumage wherever blackish is found in normal specimens. It appears that the normal blackish tones must be composed of more than one element, and that in this case some of the color elements were missing.

The present case might be called a 'color phase' for it represents somewhat the same sort of departure that is found between the two phases of the Screech Owl. The term, however, is not entirely satisfactory for several reasons, but in the absence of a better one, it may serve for the present.—IVAN R. TOMKINS, U. S. Dredge DeWitt Clinton, Savannah, Georgia.

Eskimo Curlew food note corrected.—The correcting of the identification of specimen number 7660 collected by Will E. Snyder at Fox Lake, Wisconsin, on September 10, 1912, from Eskimo to Hudsonian Curlew (Scott, Auk, 57 (4): 566-567, 1940), so alters the picture of the food of the Eskimo Curlew that we are offering the following amended summary of the stomach contents to be substituted in an account contained in an earlier paper (Cottam and Knappen, 'Food of Some Uncommon Birds', Auk, 56 (2): 154, 1939).

One of the three Eskimo Curlews, *Phaeopus borealis*, upon which this note is based was collected in 1887, in New York (Long Island City), and the two others were taken in 1888 in Massachusetts (Monomoy Island). All three were taken during September. They contained 100% animal foods as follows: spiders, 2.67%; grasshoppers (Acrididae), 40%; field crickets (including *Gryllus* and *Nemobius*), 52%; beetles, including ground beetles and scarab beetles (Carabidae, Scarabaeidae), 3.33%; moths (Lepidoptera), 1.67%; ants (Formicidae), 0.33%. The plant food consisted of but a trace of vegetable debris including one seed of a crab-grass (*Digitaria* sp.). These stomachs were respectively one-half, two-thirds, and completely full.—CLARENCE COTTAM and PHOEBE KNAPPEN, U. S. Fish and Wildlife Service, Washington, D. C.

Ruff in Iowa in spring.—On May 10, 1940, Mr. W. C. Thietje, a member of our museum staff, collected a specimen of female Ruff, *Philomachus pugnax*. It was in a mixed flock of Lesser Yellow-legs and Pectoral Sandpipers at the marsh in Louisa County, Iowa. The specimen is now in the Natural History Museum at Iowa City, Iowa.—HOMER R. DILL, Director, Museum of Natural History, Iowa City, Iowa.

Herring Gull in Guatemala.—On November 25 and 26, 1940, I saw a dark-colored immature Herring Gull (*Larus argentatus smithsonianus*) repeatedly in the harbor at Puerto Barrios, Guatemala. The bird was in company with Laughing Gulls and came close about the ship on which I was traveling so that I had no uncertainty in its identification. The species is supposed not to range ordinarily south of Yucatán, and has not been listed previously from Guatemala.—ALEXANDER WETMORE, U. S. National Museum, Washington, D. C.

Common Tern nesting at Oneida Lake, New York.—On June 20, 1937, we again visited the islands in Oneida Lake where the year before we found a flourishing colony of Common Terns, *Sterna hirundo* (Auk, 53: 446, 1936). On Wantry, the small island, we found exactly 100 nests with one to three eggs each, an increase of 69 nests over 1936. However, there were no young birds where we banded 31 young in 1936. The water in the lake was high and parts of Long Island were covered, dividing the eastern end into several small islands. The island was nearly covered to the water's edge with a triangular sedge (probably *Scirpus Torreyi*) and growing in the water was much water willow (*Dianthera americana*) and the gravelly places were much smaller than they were the year before. Nests were thick in the gravelly places and many in the thick sedges. From the number of birds in the air we estimated that there were at least 200 nests on the island, or more than double the number found there the year before. But as on Wantry there were no young birds. Two broods of young Black Ducks were seen, one of four and one of nine. There were several pairs of Spotted Sandpipers and we found one nest with four eggs. On Little Island we found 26 nests of Common Tern and one of Spotted Sandpiper but no young birds.

On July 11, Charles Spiker and I made a second trip to these islands. As we approached Wantry, more than 100 Herring and Ring-billed Gulls were resting on the bare pebbles and sand at the east end. There were just 70 nests of Common Tern (one to three eggs) and a single newly hatched young one. On Long Island the sedges were so thick and tall that it was impossible to make a count of the nests. There were several hundred Common Terns and ten or twelve Black Terns hovering over and around the island. We found more than 100 nests of Common Tern with eggs, and hiding in the sedges at the water's edge we found 18 young terns, many of them nearly ready to fly. These we banded.

We estimated that on these three small islands during the 1937 season there were at least 900 eggs laid by the Common Terns. We found only 20 young birds. What became of the others that should have hatched from the 900 eggs? Did they fall prey to the gulls?

On July 10, 1938, the water in Oneida Lake was nearly a foot lower and more of the beach was exposed than last year. The Herring and Ring-billed Gulls were there but in less numbers, the Common Tern population about the same. On Wantry we found 30 nests with eggs (one with four eggs) and about 60 young. Of these 37 were large enough to band. On Long Island every gravelly place was full of terns' nests and there were more nests scattered thickly, even out in the sedges. There were young terns of all ages, the newly hatched mottled buffy,

brown and black with solid brown cap and black chin, legs and feet orange or yellow or light or deep flesh-color, bill flesh-color with blackish tip. This downy plumage changes rapidly, the black chin disappears, the top of the head becomes mottled like the back, and under parts including the throat become white. At this time the early broods were partly or fully feathered, the upper parts pale gray with forehead brownish gray blending into the black on back of head, and under parts white. There were many of these early-brood birds hiding in the edge of the sedges or flattened among the stones on the narrow beach. Some would swim out into the lake as we approached and come back after we passed on. One that seemed fully fledged I tossed into the air and it took wing and flew around with the old birds where I soon lost track of it. One hundred and twenty young Terns were banded which used all of our bands and there were many more left without bands.

Four families of young Black Ducks and a family of young Blue-winged Teal were driven out of the tall sedges, took to the water and swam out to the grass and sedges growing in the water offshore.

In 1939, we found the Islands with more and thicker vegetation and the terns had increased in numbers, it seemed almost to the saturation point. It was impossible to count the nests owing to the dense vegetation but there were at least 150 nests and many young in the down. Most of the young were well feathered and nearly old enough to fly and kept to the shores hiding in the sedges or flattened among the stones on the beach. We banded 267 using all of our bands and left fifty to seventy-five unbanded. Only about 20 Ring-billed Gulls were there which may account for the large number of young terns found.

I could not get to Oneida Lake this year (1940). The water was probably high as it was in the other central New York lakes and conditions could not have been as good for the nesting terns.—VERDI BURTCH, *Branchport, New York*.

Historical data on a specimen of Sooty Tern from Oswego, New York.—On page 149, Part I, of E. H. Eaton's 'Birds of New York' (N. Y. State Museum Memoir 12, 1910), six records of the Sooty Tern (*Sterna fuscata fuscata*) are given for New York State. The localities cited are: Oswego, Lake Champlain, Owasco Lake, Lake Ronkonkoma, Highland Falls and Montauk.

The only information given by Eaton regarding the Oswego specimen is that it was taken "about 1875" by D. D. Stone. Perhaps now the whereabouts and earlier history of this first recorded New York State specimen of Sooty Tern will be of interest, at least to eastern ornithologists. On August 22, 1940, the same Dwight D. Stone, now of Coolidge, Arizona, and 82 years old but alert and active for one of his age, visited me at the State Museum in Albany. At that time he not only furnished me with further data concerning the Oswego specimen but offered to donate it to the Museum. The generous offer was gladly accepted and the tern was received from him on August 29, 1940.

Concerning this specimen Mr. Stone furnished the following historical background. As a youngster he lived in Oswego, New York, where, on account of his collecting proclivities and his penchant for mounting birds and other animals, he was known as the local 'boy taxidermist.' Mr. Stone cannot be more specific than "about 1875" regarding the date of discovery of the tern in question. However, he reports that following a severe storm the bird was picked up dead on the roof of the 'Doolittle House' by the janitor of that hostelry. This building was located on the bank of the Oswego River and occupied the site of the present 'Pontiac Hotel.' It was apparent that the tern had met death not long before it was

found when it flew against a vertical skylight on the roof of the hotel. The discoverer of the dead tern carried it to the manager of a local gun store who in turn transmitted it to Mr. Stone. It was then mounted by him and during the following years reposed in his private collection in Oswego.

The bird is in typical adult plumage, the few white feathers on the loreal region indicating that the postnuptial molt had occurred. Measurements: wing (extreme terminal portion of outer primaries missing), 11.8 inches; tail (extreme terminal portion of both outer tail-feathers missing), 5.8 inches; bill (exposed culmen), 1.6 inches; tarsus, 0.82 inch; middle toe with claw, 0.95 inch. This specimen has been renovated and remounted and is in a good state of preservation. It now reposes in the zoological exhibit collections of the New York State Museum bearing catalogue number 6170.

So far as I am aware, the Sooty Tern has been recorded from New York State but three times since the publication of Eaton's memoir. Two records are from Long Island, September 21 and December 24, 1928 (Auk, 46: 101, and 247, 1929); one record is for Staten Island, September 23, 1928 (Auk, 46: 102, 1929). All the birds were found dead.—DAYTON STONER, *New York State Museum, Albany, New York*.

Noddy and Sooty Terns nesting on bare ground.—In the latter part of June 1936, as a member of the Florida Audubon Society Expedition to the Dry Tortugas, Florida, I noticed what I believe to be an unusual nesting habit for the Noddy Tern, *Anous stolidus stolidus*. On the extreme east end of Bush Key approximately fifty birds (pairs) were observed to be nesting on the bare coral reefs. No nesting material had been gathered. J. B. Watson in 'Papers from the Tortugas Laboratory of the Carnegie Institution of Washington,' vol. 2, 1908, reports that "the statement has been made that the Noddy sometimes lays its eggs directly upon the ground, but this is not quite true for Noddies on Bird Key. Very often the nest has the appearance of being constructed upon the ground, but a closer examination usually shows that it has been built upon a tuft of grass or upon the stem of a bush, the branches of which have been broken off close to the ground." He also states that at no time did he find that eggs had been laid on the bare ground. It is possible that this deviation from the normal nesting habit was due to crowding in the rest of the colony. In subsequent trips to the Tortugas in 1937 and 1938 the Noddies were not observed nesting on bare ground and it was noticed that the population of the Noddy colony had decreased.

In 1937 and 1938 the Sooty Terns, *Sterna fuscata fuscata*, were observed nesting on the bare wood and iron-work of the abandoned coaling docks. The eggs were deposited on the bare surfaces with absolutely no nest material around them.—J. C. DICKINSON, JR., *University of Florida, Gainesville, Florida*.

Bridled Tern in Florida Bay.—On the morning of October 2, 1940, the writer, in company with Edward M. Moore, Audubon representative in the Florida Keys, was patrolling a portion of Florida Bay, Monroe County. While very near Stake (sometimes known as Big Low) Key about six miles northwest of Tavernier, a tern swung in and alighted on the skiff which was towing behind the patrol launch. It sat unconcerned and allowed its picture to be taken from two or three angles. We pulled up the skiff to the launch and one picture was secured at a range of about five feet.

At first glance both of us took it to be a Sooty Tern in the immature plumage but neither of us ever having seen that species in such plumage, we made careful

notes on it for future reference. Since the great nesting colony on the Dry Tortugas was famous Sooty ground, that was the species which naturally came to mind, but the writer has only been in that famous colony at egg-time, never having seen the young birds. Later on, as we came up to Bottlepoint Key some two miles to the eastward, the tern was still with us, and actually allowed us to catch it. It was banded with a no. 4 Survey band of the number 359976, and liberated on Bottlepoint Key. While the bird was in the hand notes were taken on the plumage which is as follows. The forehead and entire under parts were pure, snowy white. The top of the head and neck were quite gray and streaked with blackish. The back and wings were a very dark brown. On looking up the Sooty and Bridled Terns in Bent's 'Life Histories of North American Gulls and Terns,' on my return to Charleston, I find that the above description tallies exactly with his account of the Bridled Tern (*Sterna anaethetus melanopectera*). In the immature Sooty, the under parts are a "uniform 'olive brown' shading to grayish white on the belly." Our bird was pure white underneath from bill to, and including, under tail-coverts, and the forehead white as well. This is conclusive.

Howell gives only three records of the Bridled Tern for Florida in his 'Florida Bird Life,' so that this seems well worthy of record. Though not stated definitely, all the previous records seem to have concerned adult specimens. Certainly, in the immature plumage, there is no difficulty in distinguishing the two.—ALEXANDER SPRUNT, JR., Nat'l. Assoc. Audubon Socs., Charleston, South Carolina.

Black Terns nesting in New Brunswick.—On June 20, 1940, accompanied by R. W. Tufts, Chief Federal Migratory Bird Officer for the Maritime Provinces, and John Campbell, game warden, I found two nests of Black Terns (*Chlidonias nigra surinamensis*) in Big Timber Lake, near Sheffield, Sunbury County, New Brunswick. Each nest contained three eggs and was built upon a small mound of vegetation in the shallow lake. As many as seventeen adult terns were counted at one time flying over the lake, indicating the probability of other nests nearby.

This is believed to be the first definite nesting record of this species in New Brunswick although as reported before (Auk, 56: 476, 1939) I had found adult Black Terns in this immediate area on June 14, 1937, on May 26, 1938, and on May 24, 1939. On these dates I was unable to find any nests, partly because of the lack of time available from my waterfowl investigations.—HAROLD S. PETERS, U. S. Fish and Wildlife Service, Charleston, South Carolina.

Eastern Mourning Dove in the Dominican Republic.—The occurrence of the eastern form of the Mourning Dove (*Zenaidura macroura carolinensis*) in Cuba has been previously reported (Auk, 54: 391, 1937). The basis for that record is the recapture of two birds banded at Key West, Florida.

Upon going through the recovery records for this species in the banding files of the U. S. Fish and Wildlife Service, I discovered another case that should be noted, as it extends considerably the known range of *Z. m. carolinensis*. The bird in question was marked with band no. A-441887 at Gulfport, Florida, on March 30, 1932, by Mrs. Daisie M. Morrison. It was retaken at Santiago, Dominican Republic, about July 25, 1934.

It will be observed that all eastern Mourning Doves thus far reported from the Caribbean region are individuals that were banded in Florida. The cooperators responsible for the banding have, of course, merely listed them as "Mourning Doves" and the subspecific designation is made entirely upon geographic grounds and present knowledge of the range of the three recognized races. Nevertheless,

there is a possibility that the West Indian Mourning Dove (*Z. m. macroura*) is a more or less regular visitor to southern Florida. The date of recovery of no. A-441887 is significant and it is suggested that it might be interesting to reexamine specimens of *Zenaidura macroura* collected in the lower half of the Florida peninsula.—FREDERICK C. LINCOLN, U. S. Fish and Wildlife Service, Washington, D. C.

Color attractive to hummingbirds.—Evidence which seems to indicate that hummingbirds are attracted to certain colors was obtained on August 10, 1940, near the Utah copper mines, Bingham, Utah. A Broad-tailed Hummingbird (*Selasphorus p. platycercus*) was noted feeding on a patch of purple bee-weeds (*Cleome serrulata*) near the mouth of the two-mile Bingham tunnel. Traffic lights control the traffic at this long tunnel which is located at the base of a rather precipitous mountain-side. Twice during an interval of ten minutes, while I waited to drive through the one-way tunnel, a hummingbird poked its bill against the red light in what appeared to be an attempt to feed. That it was not attracted to the green or amber light might suggest a greater attraction to the red coloring.—CLARENCE COTTAM, U. S. Fish and Wildlife Service, Washington, D. C.

Red-headed Woodpecker in Quebec.—While searching for birds on Mount Royal, Montreal, August 30, 1939, I was surprised to see at close range two adults and one juvenal of this species, *Melanerpes erythrocephalus*, searching oak trees and a telephone pole for food. I had them in view for fully five minutes, using bird-glasses which were not really necessary. Mrs. Phillips, who knows these birds well, was with me. This woodpecker is common about Sarasota, Florida, where we now spend our winters. I notice the species is of but casual occurrence in southern Quebec according to the 1931 A. O. U. 'Check-list.'—CHARLES L. PHILLIPS, 5 West Weir St., Taunton, Massachusetts.

Arkansas Kingbird in Florida.—While at old Fort Marion, St. Augustine, Florida, May 11, 1940, I noticed a small group of large flycatchers among the lower branches of several large cedar trees near Matanzas Bay. A closer inspection with ten-power glasses showed that two Gray Kingbirds (*Tyrannus dominicensis*) and one Arkansas Kingbird (*T. verticalis*) were associating and feeding together. Possibly these birds had been winter companions farther south. The striking white outer webs of the lateral rectrices were noticeable as were the other characters of the western visitor. I at first thought that the glasses would reveal the Southern Crested Flycatcher which is common in the spring in Florida. I am familiar with all the species mentioned above as I have specimens of each, and I met *Tyrannus verticalis* in Colorado several years ago.

I have located fifteen fall and winter records of the Arkansas Kingbird in Florida, but no other spring occurrence.—CHARLES L. PHILLIPS, 5 West Weir St., Taunton, Massachusetts.

Barn Swallow breeding in southern Alabama.—In view of the uncertain status of the Barn Swallow (*Hirundo erythrogaster*) as a breeding bird in Alabama, it is felt advisable at this time to place on record the recent discovery of a breeding colony of these birds in the extreme southern part of the State. Because of the presence of Barn Swallows on the Mississippi coast during the summer months there was a possibility that they might also nest in suitable situations in southern Alabama, so an attempt was made to verify this supposition. Among the places visited was Fort Morgan, lying at the entrance to Mobile Bay, and approximately thirty miles south of Mobile, and here a colony of thirty pairs of these birds was

found nesting. On the day that this colony was discovered, June 3, 1940, the nests with one exception held young that were well grown, and in several instances almost fully fledged. The one exception was a nest that contained three fresh eggs. The nests were all characteristic of those built by this species, and were either in the Fort itself, or scattered through the adjoining buildings that originally housed ammunition for the big guns. While no definite information could be obtained as to how many years these birds had been nesting here, indications were that this colony had been long established at this spot, and had apparently merely been overlooked. In his 'Birds of Alabama' (1924), Arthur H. Howell cites as the only breeding record for the State a nest found at Tuscumbia on May 15, 1892, and in the fourth edition of the A. O. U. 'Check-list' (1931) the breeding range of the Barn Swallow is given as south to northern Alabama.—THOMAS D. BURLEIGH, U. S. Fish and Wildlife Service, Gulfport, Mississippi.

Migration of Blue Jays.—At Hawk Mountain, Pennsylvania, and along the adjacent ridges, the Blue Jay (*Cyanocitta c. cristata*) occurs in migration from the third week in September until mid-October. The jays may be seen in loose flocks, or in orderly processions, on either side of the ridge, and at any elevation, in numbers varying from twelve to three hundred or more birds. I have noticed each season that jays are on the move by 7 a. m., but by mid-afternoon their flights terminate. As a rule, the birds keep just above the treetops, and seldom is there much fuss or noise; indeed, observers at the lookout must be keenly alert to detect each passing group of jays. At times, an entire group will alight on the trees for a moment of rest. It is then that a Sharp-shinned Hawk may appear suddenly, and plunging into the jays, precipitate a confused scramble of flashing blue feathers and a chorus of screams, which may be the signal for the jays to move on. I have never seen a Blue Jay fall prey to a Sharp-shin. At Point Pelee, on the north shore of Lake Ontario, during the hawk flights of 1905 and 1906, P. A. Taverner and B. H. Swales reported migrating jays much harrassed by Sharp-shinned Hawks (Wilson Bull., 19: 142, 1907). In 1939, at Hawk Mountain, the heaviest flight of Sharp-shins on record (8,529 individuals) was coincident with the most remarkable flight of jays that I have known, but very little harrassing was noticed. Prior to the fall of 1939, I have recorded inconsequential numbers of Blue Jays, with the exception of 603 birds counted on September 26, 1935.

During a sixteen-day period beginning September 24, 1939, I made an approximate count of 7,350 Blue Jays. Doubtless many jays slipped by uncounted. The majority of the birds passed through in a constant stream regardless of the weather conditions, from September 30 to October 6. The peak of the migration came on October 1, a day of alternating rain and mist, with raw northerly winds; at least 1,535 birds passed the lookout, even during the rain, in groups of from 100 to 350. Again on October 3, despite obliterating mists during the forenoon, and fresh easterly winds all day, I counted several large flocks at various parts of the Sanctuary, and the far from complete count for the day was 1,250 birds. On October 4 I noticed a curious thing. During the forenoon the 'lookout watch' was taken by Harold Axtell, while I repaired to Dreherstown at the foot of the mountain. Standing on the railroad tracks and looking up to the crest of the ridge, I saw (in the space of fifteen minutes) three groups of jays numbering 85, 25 and 65 birds, respectively, leave the ridge and fly due west high over Dreherstown!

Other observers reported to me "large numbers" of Blue Jays on the adjacent ridges. On our big jay day, October 1, Mrs. E. C. Spaide was observing the hawk

migrations at Point Pelee, and she reports an "enormous" migration of Blue Jays from early morning until 2 p. m.—more jays than she "ever imagined sojourned in Ontario" (Jack-pine Warbler, 17: 115, 1939).

This unusual mass movement of Blue Jays is doubtless significant. A dearth of beechnuts and acorns in the northern forests may be the answer, in part. A sudden population increase may have attended an exceptionally favorable breeding season. In any event, it is interesting that this remarkable migration of Blue Jays was concurrent with the heaviest flight of hawks that we have experienced (22,704 raptors for the season).—MAURICE BROWN, *Hawk Mountain Sanctuary, Route 1, Orwigsburg, Pennsylvania.*

Fish Crow in Center County, Pennsylvania.—Mr. W. E. Clyde Todd, in his excellent work on the 'Birds of Western Pennsylvania' does not include the Fish Crow (*Corvus ossifragus*) because it has been "attributed to the eastern part of our region" on records that are "unacceptable" (p. 378).

In 1918, I spent the last week of April and the first two weeks of May at State College, Center County, and observed the Fish Crow every day I was there, usually a pair, but on several occasions I saw four birds and on April 30, a flock of seven birds flew over early in the morning uttering their noisy, characteristic cries. At that time, I was staying with Mr. Richard C. Harlow, who had spent ten years at State College and had never identified the Fish Crow. He doubted my belief at the time that the birds were Fish Crows, but subsequently acknowledged that I was right in my identification. On April 26 and April 30, I found two Fish Crows' nests at State College at widely separated localities, but did not examine them as the date was too early for eggs according to my experience with the birds at Philadelphia. Both nests were typically situated, in tops of pin-oak trees over eighty feet high. At both nests the owners circled overhead crying at my intrusion, a characteristic habit of nesting Fish Crows.

Mr. Thomas D. Burleigh spent four years at State College, 1916–20, and he also never identified the Fish Crows there. Neither he nor Harlow includes the Fish Crow in their respective papers on the breeding birds of Center County (Harlow's, 'The breeding birds of southern Center County, Pennsylvania,' *Auk*, 29: 465–478, 1912; Burleigh's, 'Notes on the breeding birds of State College, Center County, Pennsylvania,' *Wilson Bull.*, 43: 37–54, 1931).

Before I visited State College in 1918, I had over ten years' acquaintance with the Fish Crow at Philadelphia and in southern New Jersey where it is common, and know it positively, as there is no mistaking its cries, which are quite dissimilar to those of the Eastern Crow (*Corvus b. brachyrhynchus*).—RICHARD F. MILLER, *Philadelphia, Pennsylvania.*

Short-billed Marsh Wren in the western Adirondacks.—On June 15, 1940, a pair of Short-billed Marsh Wrens, *Cistothorus stellaris*, were seen in a marsh near Wanakena, New York, just within the western border of Adirondack State Park in southeastern St. Lawrence County. The male sang frequently and both birds were kept under observation by 'squeaking' when they would appear briefly from among the rank growth of sedges and other marsh vegetation. The birds showed great concern when I searched for a possible nest, and though none was found I believe they were breeding there.

The flora of this entire region is typical of the higher Adirondacks and is characterized in general by spruce flats, balsam-tamarack bogs, river marshes, and mixed coniferous-hardwood forests. The marsh surrounding Heath Pond, wherein

the birds were found, is 1500 feet above sea level and dominant plants are *Kalmia polifolia*, *Andromeda glaucophylla*, *Eriophorum viridi-carinatum*, and *Carex* spp.

Records for the occurrence of the Short-billed Marsh Wren in the Adirondack region are apparently quite rare. Dr. Merriam (Auk, 1: 59, 1884) says that Romeyn B. Hough collected two females on October 27, 1877, in Lewis County where they evidently were breeding every year. Bedell (Auk, 40: 700, 1923) recorded a male throughout the summer of 1922 near Waterford, New York, in Saratoga County. These are the only published accounts of this species I have been able to find that would indicate its approach to the Adirondacks as a breeding bird.—J. KENNETH TERRES, 220 Pleasant Street, Ithaca, New York.

Mockingbird in New Hampshire in midsummer.—A Mockingbird, *Mimus polyglottos*, was observed at Wentworth, New Hampshire, on July 19, 1940. It flew across the road one-half mile south of the town, where the Baker River crosses the State highway, route 25A. Time did not permit a search for the nest or a mate and it is doubtful if the bird were nesting, although this is not an impossibility. Successful nesting has occurred as far north as Bangor, Maine, Lunenburg, Vermont, 1884, and Brattleboro, Vermont, 1931 (Bagg and Eliot). I have found no nesting records for New Hampshire. The birds have been recorded at various times in New Hampshire but mostly in the fall and winter. However, a male was heard singing at Winchester, New Hampshire, in mid-June 1935, and another was observed at Manchester, New Hampshire, May 25, 1927 (Goellner). Winter records for the two States include: one at East Andover, New Hampshire, October 26–November 4, 1939 (K. Elkins); one at Norwich, Vermont, January 15–March 1939, and one at St. Johnsbury, Vermont, November 17–30, 1939, and several others in the southern portions of Vermont and New Hampshire.—RICHARD WEAVER, Dartmouth College, Hanover, New Hampshire.

Bicknell's Thrush in West Virginia.—On the morning of May 16, 1940, on the University Farm about one mile northeast of Morgantown, Monongalia County, West Virginia, I collected a thrush whose measurements seemed to indicate that it was referable to Bicknell's (*Hylocichla minima bicknelli*). This identification has since been confirmed by Dr. Alexander Wetmore, of the U. S. National Museum. This specimen, a female with a wing length of 93 mm., constitutes the first record of this subspecies in West Virginia, and one of the very few west of the Appalachians. It is of interest to note that for a time Gray-cheeked Thrushes were observed fairly commonly in a certain wooded area, associating with the more numerous Olive-backed Thrushes, and that three others were collected by J. L. Poland. All of these birds, one taken May 15 and two May 21, 1940 (the latter two also examined by Dr. Wetmore) have proved to be referable to the larger form (*H. m. minima*).

Wallace (Proc. Boston Soc. Nat. Hist., 41: 211–402, 1939), reviewing the alleged occurrences of *H. m. bicknelli* in the interior, concludes, "The few remaining records, if authentic, can best be explained as stragglers or accidental records rather than regular migrants."—WILLIAM A. LUNK, Fleming Avenue, Fairmont, West Virginia.

Warbling Vireo in Cape May County, New Jersey.—Dr. Witmer Stone, in his classic 'Bird Studies at Old Cape May,' says he has been "unable to obtain a single record" of the Warbling Vireo in the county, and also that "none has been recorded" for that region. When I gave Dr. Stone my nesting data of Cape May birds I overlooked a record of the Warbling Vireo, *Vireo gilvus*, of a bird that Mr. T. E. McMullen and I observed on June 8, 1919, at Cold Spring. It was a

singing male whose song attracted our attention as we approached a farmhouse, and came from a large, branching white-poplar tree on a lawn in front of the dwelling. We spent some time watching the bird, who sang persistently, and we searched unsuccessfully for its nest.

This is the only Warbling Vireo I have ever seen in Cape May County, and at the time of its observance, I was unaware of its rarity in southern New Jersey, where I have seen it three other times in June, viz., June 9, 1915, Westmont, Camden County; June 29, 1928, Palmyra, Burlington County; June 16, 1932, Pennsville, Salem County. All of these birds were singing males and were undoubtedly nesting, but we were unable to find their nests.

I have never seen a Warbling Vireo in July or August, nor during September migration in southern Jersey, and have very few May records of its occurrence in the State. In fact, I have seen the Warbling Vireo on very few occasions anywhere in late summer and fall.—RICHARD F. MILLER, *Philadelphia, Pennsylvania*.

Western Meadowlark in New Jersey.—On April 28, 1940, with Miss Miriam Min-ton of Metuchen, I made an early-morning trip to the region south of South Plainfield, New Jersey, in order to take a census of the Upland Plovers that are usually to be found there. While driving slowly along a country road and listening carefully for the notes of the plover, my attention was called to a beautiful and very familiar song. I said at once to my companion, who is an enthusiastic bird student, "That is the song of the Western Meadowlark!" Presently our binoculars revealed the bird (*Sturnella neglecta*) sitting on a fence post about one hundred yards distant. We slowly approached the bird until we were within fifty yards of it. During this time it had poured forth its complete song a number of times. We watched it until it flew to a distant field. As I am very well acquainted with this bird in the West and have spent many hours listening to its gorgeous songs, including the flight song, there is not a possible doubt as to correct identification.

On May 1, 1940, I made another trip to this locality hoping to hear the bird again. The fields were searched for some distance in every direction during the two and one-half hours I was there, but there was no trace of our western visitor. I spent many other mornings in May in this section of the country but without result, so I conclude the bird had wandered farther afield. I am unable to find a single authentic record of this bird's appearance so far east.—JOHN T. S. HUNN, *1218 Prospect Avenue, Plainfield, New Jersey*.

Probable breeding of the Beautiful Bunting in the United States.—Although the fourth (1931) edition of the A. O. U. 'Check-list' implies, on page 316, that the Beautiful Bunting (*Passerina versicolor pulchra*) is a regular resident of "extreme southeastern California," we know of but one published record for that State: two specimens taken by Dr. J. A. Hornung from "fifteen or twenty" seen at Blythe, on the Colorado River, February 8-9, 1914 (Daggett, Condor, 16: 260, 1914). The only other record published to date for the United States is that of a female taken by Frank Stephens at Crittenden, Santa Cruz County, Arizona, July 14, 1884 (Brewster, Auk, 2: 198, 1885).

During June 1940, the writers made a three-day survey of the bird life of the west slope of the Baboquivari Mountains, at the east end of the Papago Indian Reservation, Pima County, Arizona. Observations were made from Baboquivari Camp (in Baboquivari Canyon a bit below the mouth of Moristo Canyon) to well up in the pinyon-juniper-oak-locust woods of Baboquivari Peak. Our most in-

teresting find was a colony of Beautiful Buntings, apparently the first to be discovered in the United States.

On the morning of June 12, the senior author found two pairs of the birds in dense thorny thickets well up in Baboquivari Canyon. Here, at the foot of a cliff on a rough, steep slope, the males sang repeatedly. Though one pair was observed mating, no nest was found. The male of this pair was finally collected. Meanwhile Phillips and Hargrave, who were preparing specimens at Baboquivari Camp, took two males and one female there. All three of the above-mentioned males were plainly in breeding condition, but the ovary of the female was only slightly enlarged, the largest eggs being 1 mm. in diameter, and in none of the four birds was there any indication of a brood patch.

During the evening of that same day the senior author saw four males in the lower part of Moristo Canyon, about half a mile above camp. On June 13, Sutton and Phillips saw three or four males and one female in the catclaw and mesquite brush of a small flat in this same section, and a pair in mesquite, *Baccharis*, etc., near the mouth of the canyon. No new nests were found, but two old nests which were much like those of other members of the genus *Passerina*, but a little less bulky, were found several feet up in the thorn brush.

On June 13, our party detected a total of two males and one female at and near Baboquivari Camp. On June 14 a single male was seen there by Sutton. That day our activities centered in the higher parts of the mountains and in our return to Tucson. We saw no other *Passerina* anywhere in the region.—GEORGE MIKSCHE SUTTON, ALLAN R. PHILLIPS, and LYNDON L. HARGRAVE, Cornell University, Ithaca, New York.

Natural death of a Fox Sparrow.—In 'The Condor,' September 1924, Laurence M. Huey describes the natural death of an Audubon's Warbler (*Dendroica auduboni*) under the title 'The Natural End of a Bird's Life.' Huey describes the bird as "ascending a vertical rose stem in a peculiar spiral manner" and otherwise conducting itself in a very abnormal fashion. Shortly afterward the bird fell dead to the ground and was examined externally and internally by Huey, who could diagnose nothing that might have had a lethal effect.

Late in the afternoon of November 23, 1937, the author flushed a Fox Sparrow (*Passerella iliaca*) at unusually close range in an apple orchard at the State Institution of Applied Agriculture, at Farmingdale, Long Island, New York. The bird perched erect on the lowest limb of a large tree and gave every appearance of perfect health. A few seconds later it dropped back into the grass, presumably to resume feeding. (It was not easy for me to be certain at this distance that the bird had dropped head foremost, as it had appeared to do.) The writer walked slowly forward, expecting to flush the sparrow again, but soon came within sight of the trembling bird approximately five seconds before its death. A cursory examination revealed no parasites. Freezing or emaciation seemed unlikely; the temperature had remained near normal for several weeks previously and read slightly above 40 degrees F. at the time. There had been no snow on the ground.

Aside from these two records, the author can find no data on a bird's death from causes which were presumably natural. Such occurrences must undoubtedly be quite rare.—HENRY M. STEVENSON, JR., 724 Eighth Avenue, West, Birmingham, Alabama.

Notes from Hawk Mountain (Kittatinny Ridge), Pennsylvania.—In the course of six three-month periods of almost daily census-taking of hawks (the fall seasons

of 1934 to 1939 inclusive), I have recorded a few locally rare or unusual birds. Lulls in the hawk migrations frequently permit close observation of passerine birds, which at times swarm over the ridge. While I have perched like a linnet atop Hawk Mountain during the period cited, 140 species and subspecies of birds have passed my scrutiny!

Impressive numbers of waterfowl winging through the autumn skies, have been an added source of interest and inspiration to observers of the hawk migrations. Fifteen species of waterfowl, including Whistling Swans, have been recorded to date, and Herring Gulls, Ring-billed Gulls and even shorebirds are also seen occasionally. Common Loons, like animated crosses, are often seen passing high over the ridge, usually in precipitous flight; as many as 86 loons have been counted on one day, November 18, 1937. In most instances the waterfowl and gulls are seen flying due north-south, and therefore at right angles to the ridge (which locally has a strictly east-west trend). Only the raptors and the passerines follow the course of the ridge, the former utilizing the air currents, as is well known. Movements of migrating waterfowl over Hawk Mountain occur nearly always immediately after a severe storm.

RED-THROATED LOON, *Gavia stellata*.—Four of these birds seen early in the morning of October 8, 1939, were literally 'in a fog.' Misty, lowering weather, with a raw southeast wind prevailed when the loons loomed up suddenly only a stone's throw from the lookout, coming toward us on a level with our position. They had been flying parallel with the ridge, only a few feet above the tops of the trees. A few days later, on October 15, three more Red-throated Loons flew over, rather low, but in the customary north to south direction.

AMERICAN BRANT, *Branta bernicla hrota*.—Four occurrences of Brant in the fall, at Hawk Mountain, are noteworthy, inasmuch as this species is seldom recorded away from coastal areas, or off its main paths of migration (cf. Harrison F. Lewis, Auk, 54: 73-95, 1937). On October 18, 1936, a bleak, blustery day at the Sanctuary, following a period of very stormy weather to the north, we saw seven flocks of Canada Geese, aggregating 485 birds. In one flock of forty geese a single Brant was identified. The same season, in the forenoon of November 18, fifteen Brant in V-formation passed within two hundred feet of the lookout. One of the most amazing sights I have experienced at Hawk Mountain, however, was that of some 225 Brant, at 2.45 p. m. of November 9, 1938. The birds came out of the north in a compact, formless mass, and passed directly over me in a faintly audible wave of swishing wings. On October 21, 1939, we identified eleven Brant. So far as I know, the only other local (Berks County) occurrence of Brant is of a single bird observed at Lake Ontelaunee (near Reading) on November 10, 1932, by Earl L. Poole.

SNOW GOOSE, *Chen hyperborea*.—The paucity of records of Snow Geese (presumably *C. h. atlantica*) in Pennsylvania has been commented on recently by C. Brooke Worth (Auk, 56: 329, 1939), and by J. K. Terres (Auk, 57: 107, 1940). Worth cites but three fall records that he has been able to discover. To these I submit two additional records. October 12, 1936, was a cold clear day of high northwest wind, and many hawks were on the wing. During the forenoon, to the great interest of a score of observers, a loose flock of nine Snow Geese passed high over the ridge, some distance to the east, too far off to be heard. Some thirty Pintails, three Black Ducks, twenty-four Canada Geese, and over a hundred Double-crested Cormorants passed a few minutes after the Snow Geese. Again, twenty-six Snow Geese late in the afternoon of October 30, 1938, created much excitement in a

large gathering of observers who had experienced a poor day for hawks. This flock of geese was low-flying and exceedingly noisy. The birds were in such loose formation that five became dissociated from the main group and, cackling lustily, continued southward scarcely more than 150 feet above the treetops, directly over the entrance to the Sanctuary, where I happened to see them.

AMERICAN SCOTER, *Oidemia americana*.—A singular occurrence of nineteen American Scoters, passing fairly close to the lookout at a low elevation, was noted about mid-day of October 17, 1939.

NORTHERN RAVEN, *Corvus corax principalis*.—I have nine records of this species. Single birds occurred on October 14 and November 2, 1934 (Auk, 52: 311, 1935). In the forenoon of October 2, 1935, my wife and I saw a Raven sail low over the ridge, passing from northeast to southwest, and twice we heard a throaty *croak*; at 4.05 p. m., a Raven (the same bird?) flew by in reverse direction. The same season, October 15, seven members of the West Chester (Pennsylvania) Bird Club and myself saw two Ravens, one at 2.30 p. m., and the other at 2.50 p. m., both following the course of the ridge. On October 12, 1936, a number of observers were fortunate in seeing a Raven pass within fifty feet of the lookout; the bird flew up the ridge toward the east. A large gathering of observers had an excellent view of a Raven on October 14, 1939, and very early the next morning two birds were seen by Millard R. Lindauer, Robert Newman, and W. Bryant Tyrell.

BEWICK'S WREN, *Thryomanes b. bewicki*.—On September 30, 1934, I studied a bird of this species for nearly ten minutes, in the low growth bordering the dirt road, near the entrance to the Sanctuary. No other local records obtain for this wren, so far as I know. I have had considerable experience with the Bewick's Wren in the South.

SNOW BUNTING, *Plectrophenax n. nivalis*.—I have seen two Snow Buntings at our Sanctuary lookout: the first, on November 18, 1936, a low-flying bird, following the course of the ridge; the other on November 2, 1937, alighted on the great barren pile of rocks beside me and loitered several minutes before continuing its journey in a southerly direction. So far as I know, there are no other records of Snow Buntings for this region during the present century.—MAURICE BROWN, Hawk Mountain Sanctuary, Route 1, Orwigsburg, Pennsylvania.

Maritime Birds occurring with summer storms near Charleston in 1939.—At frequent intervals during the summer of 1939, I was on the outer beach at the Isle of Palms, a South Carolina sand-barrier island in Charleston County. While there I spent some part of the time in observing with interest the bird life of the strand and the adjacent ocean. This resulted in the discovery of two species unusual on the Carolina coast: Audubon's Shearwater (*Puffinus lherminieri*) and Noddy (*Anous stolidus*). Tropical oceanic birds often occur on this coast with the passage of storm areas originating in or near the tropics. The occurrence of the Noddy as cited below is an example of a species blown by storm winds beyond its normal range. That heavy local storms may account for some mortality even among such strong-flying forms as the shearwaters, may be seen by the following account. I have drawn from the Weather Bureau's data of the accompanying atmospheric disturbances which I have discussed in some detail in an attempt to shed light on the method of dispersal of maritime birds by storm factors.

AUDUBON'S SHEARWATER, *Puffinus lherminieri*.—On July 24, 1939, a specimen of Audubon's Shearwater which had just washed ashore was found dead on the beach at Isle of Palms, South Carolina. Although this species has its nearest breeding

grounds in the West Indies it is said to be fairly numerous in the summer over South Carolina coastal waters some distance from shore where it follows fishing boats. It seldom reaches land in this country, however. There are, for instance, only two records of its occurrence, both following storms, listed in the Charleston Museum's 'Second Supplement to Arthur T. Wayne's "Birds of South Carolina."'

Apparently the unusually heavy rains and winds forced down this specimen at sea. On the two previous days rainfall at the Charleston weather station totaled 7.86 inches and winds were southeast off the sea and about 22 m.p.h. velocity. Ships to the northeast in the Atlantic reported considerably stronger wind movement. This storm was the result of a continental low-pressure area that crossed the southern States on the preceding days and there was no tropical disturbance attending it. Probably this shearwater was one of the local offshore population that succumbed to the unusually heavy coastal rain and wind.

Noddy, Anous stolidus.—At the Isle of Palms on the morning of August 14, 1939, with rain squalls coming in from the sea and some intermittent sunshine, I discovered a Noddy Tern resting on the sand at the edge of the open ocean. It appeared exhausted, permitting me to approach to within fifteen feet, but then took wing normally although in a leisurely fashion. The tern skimmed the breakers southward an eighth of a mile or so and showed unusual attitude toward persons on the beach. It fluttered just out of reach among surf fishermen apparently out of curiosity. Passing on over shallow water, it paused to circle over swimmers who could have caught it by hand, attracting notice by its lack of caution. After a flight of a quarter mile or so it had returned several times to the sand where it alighted. After two attempts, with the help of an interested onlooker, this Noddy was secured by the simple method of stalking it with moderate care and dropping a towel over it. Inspection showed it to be in dry plumage and in good condition. Constituting the third record of the species in South Carolina, the specimen is now in the Charleston Museum's collection.

Some interest attaches to the course of this tropical hurricane which beached this Noddy about 400 miles beyond its normal range. The storm center was reported near Puerto Rico on August 8. Its movement was northwestward over Haiti and Cuba, advancing toward the United States across the eastern Gulf of Mexico. Early movement of the storm was rapid so that by August 12 it was centered in the Gulf of Mexico with center nearest Tampa which recorded 3.47 inches of rain, although the barometer read only 29.96 inches. Newspaper reports claimed wind velocities of 60 m.p.h. although the disturbance was classed by the Weather Bureau as of moderate intensity. The storm reached the mainland on the Florida panhandle and had moved by August 15 to northern Alabama with a presumably diminished intensity of 29.83 inches at center. At Charleston, South Carolina, the approach of the storm caused general cloudiness on August 13 with rain squalls. The wind direction was southeast and maximum minute-velocity 26 m.p.h. Rainfall was moderate with 0.63 inches. On August 14, when the Noddy was captured, the weather was clearing as the storm lost force over Alabama.

From these data it may be assumed that this hurricane crossed more or less directly the breeding range of the Noddy. Apparently this bird was carried on the eastern half of the storm where winds were at all times from the southeast. It seems probable that this individual started its flight in the central storm area where gales forced it northward. By the time the Carolina shore was reached the bird had moved toward the calmer periphery of the storm, being already some 400 miles from the center, and somewhat in advance of it. This is in contrast to

those cases where the birds are carried in the so-called 'central eye' of the hurricane.
—JAMES A. BRUCE, 32 W. Bee Street, Charleston, South Carolina.

Notes from northern Lower California.—Between August 14 and 17, 1940, the writer, in company with Karl W. Kenyon of La Jolla, California, was camped near the sea at the mouth of the Santo Tomas River, some thirty miles south of Ensenada, Lower California, Mexico. Among the considerable number of birds listed, the following three seem worthy of record.

COLNETT'S RUFOUS-CROWNED SPARROW (*Aimophila ruficeps lambi*).—This bird was found in greater numbers than the writer had ever observed Rufous-crowned Sparrows anywhere, both on the hillsides facing the sea, and in the grassy, brushless areas, which were beginning to recover from incendiary fires. It is a common practice for the natives to start fires in the chaparral and leave them to burn themselves out, in the belief that better cattle-feed will result.

LESSER YELLOW-LEGS (*Totanus flavipes*).—On the afternoon of August 14, Kenyon collected an adult male of this species as it was feeding near the surf line on the sandy beach. Through his generosity the specimen is now no. 18197 in the collection of the San Diego Society of Natural History. It apparently represents the first capture of a Lesser Yellow-legs north of Cape San Lucas in Lower California and the first recorded instance for the entire peninsula since M. A. Frazar made his unparalleled collection of Cape birds in 1887.

RED-BELLIED HAWK (*Buteo lineatus elegans*).—As we drove out on August 17, when we came to the last of the large sycamore trees about two miles west of Santo Tomas, a pair of Red-bellied Hawks was seen. This observation adds another record to the few already made for Lower California (see Grinnell's 'Distributional Summation of the Ornithology of Lower California,' Univ. California Publ. Zool., 32: 109, 1928) and marks the first time that the writer, in his seventeen years of Lower California ornithological experience, has observed this hawk on the peninsula.
—LAURENCE M. HUEY, *San Diego Society of Natural History, San Diego, California.*

Interesting records from high elevations on Mount Rainier, Washington.—On June 27, 1940, some interesting birds were recorded from near the summit of Mount Rainier (14,408 feet) in Washington by a party of Park Rangers and Rainier National Park Company guides who ascended this ice-clad volcano in connection with their usual early-season duties. The party consisted of Asst. Chief Ranger William Butler, the leader, and Park Rangers Larry Jensen, Robert Weldon, Gordon Patterson, Darwin Williams, Paul Shaffrath, Robert Jeffery, and Rainier National Park Company guides Deo Molenaar and Kenneth G. Spangenberg. The following birds, frozen and lying upon the surface of the snow, were found between the 13,000-foot elevation and the crater rim, just beneath the actual summit at Columbia Crest. A Golden Pileolated Warbler (*Wilsonia pusilla chryseola*) was found at the highest elevation—upon the outside of the crater rim near Register Rock; the two other birds were found at slightly lower elevations, namely a Little Flycatcher (*Empidonax traillii breusteri*) and a Golden-crowned Sparrow (*Zonotrichia coronata*).

The birds were picked up and brought to the Park Museum at Longmire where they were identified. From the condition of the birds they had been lying there for some time and, unfortunately, they could not be saved for the museum study collection.—C. FRANK BROCKMAN, *Park Naturalist, Mt. Rainier National Park, Washington.*

'Anting'; termites.—So far as I know, only two of the ants used by American birds have been identified. It would be interesting to know, for instance, if the birds make any choice between stinging and biting ants. The two recorded species are biters. If specimens of ants used, with data, are sent me in 70–80% alcohol ('rubbing alcohol' will serve), I will undertake to have them identified.

I will do the same for termites, in alcohol, from swarms attacked by birds. There is much to be learned about 'ornithoentomology.'—CHARLES H. BLAKE, *Lincoln, Massachusetts*.

FIFTY-EIGHTH STATED MEETING OF THE A. O. U.

THE Fifty-eighth Stated Meeting of the Union will be held in Denver, Colorado, on September 1–4, 1941, followed by two field trips: to the top of Mt. Evans (14,000 feet) on Friday; and on the prairies all day Saturday. There is a good road to the top of Mt. Evans, which is the highest place in the United States that one can drive in a car. Headquarters will be the Cosmopolitan Hotel, Broadway and 18th St., Denver, where the annual banquet will be held on Wednesday night. All meetings will be held in Phipps Auditorium of the Colorado Museum beginning Tuesday morning. The Local Committee is: Dr. Alfred M. Bailey, *Chairman*, Fred G. Brandenburg, E. R. Kalmbach, R. J. Niedrach, and C. C. Sperry, to whom further inquiries may be addressed.

RECENT LITERATURE

'Familiar Hawaiian Birds,' its author, J. d'Arcy Northwood, says, "has been written in the hope of helping those interested to identify birds likely to be seen in the Hawaiian Islands." It is illustrated with water color sketches by Keichi Kimura.¹

Any information we receive about the birds of the Hawaiian Islands is always welcome, and Mr. Northwood gives us some first-hand news of *Hemignathus ellisianus*, a bird which ornithologists had thought extinct, and of other less rare species. A slight correction might perhaps here be made. Mr. Northwood says (pp. vii, viii), "It [*H. ellisianus*] has not been reported since 1888 . . . and only one specimen of it, which is in the Museum of Berlin, exists." Actually, there are three specimens, one in Berlin and two in Leyden; these were collected by Herr Deppe in 1834.

There are several local records which have not appeared in print. The Wedge-tailed Shearwater (*Puffinus pacificus cuneatus*) and the Red-footed Booby (*Sula sula rubripes*) are reported to be breeding on the small islands off the windward coast of Oahu, and some migrant ducks are also reported from that island.

Mr. Northwood has chosen seventy birds, both native and introduced species. These are listed under their English and Hawaiian names, with a short description and some notes. Scientific names with corresponding numbers appear in an appendix; these are apparently extracted from an unpublished list by E. H. Bryan, Jr. The rarer indigenous mountain forms such as *Pseudonestor xanthophrys* which may still be found on Maui, and *Psittacirostra psittacea*, which may still be found on Hawaii and other islands, are omitted. Indeed, only six Drepanidae are mentioned.

"Much of my information on the birds of the other islands," Mr. Northwood says, "comes from correspondence, since my residence has been confined chiefly to Oahu." Even so, it is a sad commentary that of the seventy familiar birds he lists, thirty are introduced species. In writing of the causes of the extirpation of native birds (p. xii) he says, "One of the most important . . . was the introduction of bird diseases." Yet we learn that "exotics" are still being imported.—J. C. GREENWAY, JR.

Mrs. Govan's 'Wings at my Window.'—What small events may completely change the current of our lives! In this little volume we learn how the sight of a small blithe Chickadee appearing on her piazza rail in the midst of a winter snowstorm brought new courage and inspiration to a disheartened invalid at a crucial time of stress; how the companionship and daily care of the many birds that later came to bird-shelf, feeding boxes and water pans, developed into an absorbing interest and pleasure; how, through forgetting her own discomfort, she overcame physical distress and at length regained normal health; how she became an ardent bird-bander and felt the thrill of welcoming in succeeding years her bird friends with their numbered bracelets; and how at last she was able to establish a permanent sanctuary for birds near her Lexington home. In all this, the author's enthusiasm is contagious; she takes the reader frankly into her confidence, so that we come to know not only her birds but the whole family as well, and like them!

Many interesting observations on habits are recounted and there are excellent directions for preparing attractive bird foods. Of course, the 'cold scientist' will criticize the humanizing of the birds and the interpretation of their actions as at times 'anthropomorphic,' nevertheless he will scarcely deny that birds do have

¹ Northwood, J. d'Arcy. Familiar / Hawaiian Birds / roy. 8vo, xiii + 63 pp., 12 pls., 1940; Thomas Nickerson, Honolulu. Edition limited to 330 copies.

personality. And perhaps one who in the course of a single year strews over six-hundred pounds of special food for the wild-bird visitors she loves, is entitled to regard them with motherly affection. Thus in our more sober pursuit of facts and their meaning, we learn that aesthetic values too are precious and that 'the charm of birds' may prove healing to the soul.

In this bright narrative,¹ running over with enthusiasm, the author can hardly fail of her purpose—to impart to others, old and young, some measure of her own delight in the observation and companionship of these fellow creatures.—G. M. ALLEN.

Babson's 'Modern Wilderness.'—The Spanish have a saying: 'If you do not get what you like, you must like what you get.' Hence, if there are no longer unexplored frontiers near our crowded eastern cities, we may, as Dr. Chapman points out in his 'Foreword,' still find recreation and thrills of discovery in the more commonplace forms of wildlife still surviving near at hand.

In this very readable volume² the author introduces us to an attractive swamp region near the Passaic River, New Jersey, where year by year, since boyhood, he and his companions have canoed, hunted for ducks, searched for nests of Barn and Great Horned Owls, fished for snapping turtles, sought for migrating birds and chatted with trapper Jean. Added to the descriptions of these varied experiences are occasional reflections of a philosophic sort and laments on the destructiveness of man. One is reminded of another writer, Charles C. Abbott, who half a century ago, wrote in similar vein of his 'Wasteland Wanderings' and other natural-history adventures in the country about Trenton, New Jersey.

Though the author gives us little in the nature of contributions to natural history, nevertheless this record of his own pleasurable experiences cannot fail to strike a responsive chord in the hearts of others who find helpful recreation in the observation and photography of birds and other wildlife. The many photographs of owls, old and young, the nesting hawks, ducks, woodcock and others, reveal the unexpected resources of an unspoiled natural area within sight of swarming traffic. This is a book that will be enjoyed by amateur naturalists old and young.—G. M. ALLEN.

Rorimer's 'Field Key to our Common Birds.'—One's first thought on picking up this little volume³ is "What! Another field guide!" Yet it has many good points and several unusual features. It is designed to help the amateur in identifying the common eastern species, especially in the region of northern Ohio. The index to illustrations and descriptions comes first instead of last, a convenience perhaps in quick handling; there is no table of contents but we start directly with an outline of the plan of the book and how to use it; the birds are grouped first according to habitats and sizes; then follows a 'Field Key' in which under each type of habitat a dichotomous key to the species occurring in it is given based mainly on size and color characters. This method, though instructive and interesting, is naturally full of pitfalls. Various sketches occur in the text and eighteen plates by Peterson, some in color, illustrate in semi-diagrammatic poses most of the species mentioned

¹ Govan, Ada Clapham. *Wings / at my Window / Illustrated by Dorothy Bayley*. 8vo, xiv + 198 pp., Oct. 1940; The Macmillan Co., New York City. Price \$2.50.

² Babson, William Arthur. *Modern Wilderness*. With a Foreword by Dr. Frank M. Chapman. 8vo, xix + 261 pp., illustr., 1940; Doubleday, Doran & Co., Inc., 14 West 49th St., New York City. Price \$3.00.

³ Rorimer, Irene T. *A Field Key to our Common Birds*. Illustrated by Roger Tory Peterson. 16mo, 160 pp., 18 pls., Nov. 1940; Pocket Nat. Hist., no. 8, zool. ser., no. 3, The Cleveland Mus. Nat. Hist. \$1.50.

in the text. It is too bad that those illustrating some of the thrushes, vireos and flycatchers might not have been colored too, since the differential points are not very evident in small black and white figures. The latter part of the book consists of more detailed though brief descriptions of the birds arranged in systematic order with English and Latin names. The flexible green covers, the pocket size, and the simple method of treatment should make this a guide that will appeal widely to those interested in identifying the common birds about them. It forms the eighth of the 'Pocket Natural History' series issued by the Cleveland Museum of Natural History to encourage an intelligent interest in the local fauna, flora, geology and archaeology.—G. M. ALLEN.

Salomonsen on Moults of the Rock Ptarmigan.—In this elaborate monograph¹ the author presents a minute study of the process of moult during the cycle from dark summer to white winter plumage in the Rock Ptarmigan, *Lagopus mutus*, and its races as deduced from nearly 1300 skins representing the range from Scotland to Northeast Greenland and Spitsbergen. As the late Jonathan Dwight, Jr., long ago pointed out, the matter is complicated by the fact that in spring and autumn the birds show for a time an intermediate condition, the 'tutelar' plumage. Salomonsen not only corroborates his account, but shows further that actually a new plumage is developed three times during the year. Thus the autumn moult results in the production of new dark feathers and corresponds to the complete annual moult characteristic of most birds. These dark feathers are succeeded by the pure white winter plumage, which is additionally thick through the coming in of a greater number of all-white feathers. In spring there is a third moult which, however, is incomplete and does not involve all the flight feathers. The white plumage is therefore a third or supplementary plumage. It is shown that the testis hormone does not provide the stimulus for the spring moult for this may take place much later than the initiation of courtship activity and turgidity of the red eye-wattle which are clearly controlled by this hormone. The author believes that the controlling factors initiating moult are temperature and the thyroid hormone. However, the action of the latter is still imperfectly known, and it is hard to see why its presence in autumn and reduction in spring should both act as stimulators; nor does the action of light or its reduction seem to have been taken into account, with the waning or the waxing seasons. The weak spot in the paper is that no experimental work under controlled conditions seems to have been undertaken. Nevertheless the process of moult is here very thoroughly mapped and will offer a basis for further study of the physiological processes involved.—G. M. ALLEN.

Campbell's 'Birds of Lucas County' provides an excellent summary of the bird life of this northernmost county of Ohio and is the result of the author's own intensive work in that area during the last fifteen years or so. The region is one of particular interest not only because of the diversity of habitats found in a relatively flat country, but also because it covers a transition from the more typical eastern coastal to the beginning of the western prairie fauna. On its eastern borders is Lake Erie, bringing in many waterbirds, especially those using the Mississippi Valley 'flyway'; agriculture has resulted in an alteration of the original tree cover, except in certain areas where, as in the 'oak openings,' the unproductive nature of the soil has caused these to remain largely uncleared. The wet prairies afford

¹ Salomonsen, Finn. Moults and sequence of plumages in the Rock Ptarmigan (*Lagopus mutus* (Montin)). Videnskabelige Meddelelser fra Danske Naturhist. Forening, Copenhagen, vol. 103, 491 pp., 57 figs., 5 folding graphs, 1939.

breeding ground for a limited number of species while others, such as the Lark Sparrow, are found in bare sand dunes. These various conditions are briefly described in opening chapters and there is a valuable history of the avifauna, so far as it can be pieced together, with an account of the many changes due to settlement and clearing, and the introduction of alien species. The Wild Turkey was last seen in 1892; the Eastern Prairie Chicken persisted hardly a decade longer, and even the Ruffed Grouse was extirpated by 1905; the Sandhill Crane, once a breeding bird, was gone by about 1913. Other aspects of change are interesting: Golden Plover are slowly increasing; but Wood Ducks very little, perhaps on account of the lack of suitable nesting places. The Arkansas Flycatcher has nested in the county once of recent years, but the Sycamore and the Hooded Warblers have nearly disappeared on account of timber destruction. The wide fluctuations in numbers of the Dickcissel indicate that special study is needed to fathom the causes.

Altogether this is an unusually well prepared and carefully considered local list,¹ which with its appended migration tables should help to arouse more interest in the birds of the region. There is no bibliography, but this is perhaps because of the small amount of pertinent literature. One may protest, however, against the frequent use of 'data' as a singular noun; also, the term 'summer visitor' might better be used for the American and Snowy Egrets, and Little Blue Heron which invade the county at that season, rather than 'summer resident,' which ordinarily implies breeding status.—G. M. ALLEN.

Miss Trimble's 'Changes in Bird Life at Pymatuning Lake' is a well-written paper² of unusual importance in that it affords a summary of changes that have taken place over a period of years during which Pymatuning Swamp has been converted by human agency into a reservoir lake. Before its waters were dammed, the flora and avifauna of the area had been carefully studied so that a nearly complete picture of the former conditions is available for comparison with that resulting from the change. Part of the swamp lay in eastern Ohio and a larger part in western Pennsylvania, forming a great horseshoe some sixteen miles in length, covering about twenty-five square miles. Geologically it was a large post-glacial lake which, in the centuries since the retreat of the ice, has gradually become occluded by a succession of vegetal types growing outward from the shores, to the center. In the present era it still retained a dwindling relict flora and avifauna, including a number of more boreal species, which were being slowly superseded by more southern 'Carolinian' forms.

In 1931, the main dam for the conversion of the area into a lake was begun near Jamestown, Pennsylvania, and the clearing of the old swamp forest started in 1932. It is now the largest lake in Pennsylvania, with a maximum depth of thirty-five feet.

The record of its changing bird life here given, concerns mainly the waterbirds and shorebirds, and these changes have already been great, even startling. Lying near the important Mississippi Valley migration route, "the new lake has attracted migrating water birds in great numbers" and "has become increasingly popular as breeding territory for a number of species" of which no less than twenty-one have been added over a six-year period, among them such breeding ducks as Baldpate, Pintail, Green-winged Teal, Shoveller, Red-head, Ring-necked and Ruddy Ducks. A table giving a comparison of the species occurring as migrants, stragglers, or

¹ Campbell, Louis W. 'Birds of Lucas County' [Ohio]. Bull. Toledo Mus. Sci., 1: 1-225, map, Oct. 1, 1940; published by the Toledo Zoological Soc., Toledo, Ohio.

² Trimble, Ruth. 'Changes in Bird Life at Pymatuning Lake, Pennsylvania.' Annals Carnegie Mus., Pittsburgh, 28: 83-132, pls. 8 (map) -11, Oct. 4, 1940.

breeders in 1928, with those found at the present time, summarizes these changes, while the annotated list that follows provides additional details. A bibliography of pertinent titles since Dr. Sutton's list of 1928 completes the paper.

This detailed report of faunal changes correlated with change of aquatic conditions forms an ecological record of unusual value and significance and affords a firm basis for the evaluation of future changes and for the study of adaptability in birds.—G. M. ALLEN.

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CONSERVATION NOTES

BY FRANCIS H. ALLEN

THOSE ornithologists who want to keep the shorebirds off the gamebird list should be on their guard. The subject of an open season for the larger species has already been discussed in the sporting columns, and it may be that a serious movement in that direction is on foot. It is understood that the Fish and Wildlife Service has no intention of altering the present regulations as to these birds, but all interested in keeping them protected the year round should be ready to do what they can for them.

PERHAPS the most important work that can be done for the conservation of birds and for conservation in general lies in the education of children. Much has been done in that field of recent years, but only here and there and in ways that are small in relation to the whole problem. Now at last a far-reaching campaign is being launched by the National Wildlife Federation, which plans to obtain the introduction of authoritative texts on various branches of conservation into grade schools all over the country. It is not expected that conservation as such will find its way at once into the curricula, but it is expected that teachers will use the books in teaching various subjects and also outside of school hours. The books have been prepared by a committee of educators with the criticism of professional conservationists of countrywide reputation. The system will be introduced gradually in different parts of the United States, and the plan is to have the distribution financed by public-spirited individuals and organizations.

THE National Audubon Society and the Feather Industries of America, Inc., which is said to control at least ninety per cent of the feather business of the country, have entered into an agreement whereby within six years the trade will dispose of all illegal or suspected illegal feathers, during which time the State of New York is expected to pass legislation that will put a definite stop to the importation and sale of all wild-bird plumage—legislation that it is hoped will be followed by similar legislation in the other States. The dealers agree to turn over to the New York Department of Conservation immediately their entire stocks of Bald Eagle, Golden Eagle, Bird-of-Paradise, Egret, and Heron feathers, to be destroyed or distributed to educational institutions on the passage of the new legislation.

THE situation of the White-winged Dove in the Southwest appears to be getting more critical. The Fish and Wildlife Service is considering year-round protection for the species in Arizona and shortening the open season in Texas. The National Audubon Society is taking an active interest in these birds.

THE Fish and Wildlife Service reports that the Whooping Crane count in the Aransas Refuge in Texas was twenty-six this winter, an increase of four over last year, but that only five of them were immature birds against seven young in 1939-40. With this apparent rate of reproduction the outlook for the species seems not very encouraging.

NATIONAL Wildlife Restoration Week comes in April this year, the week of April 14-19. In this year of national defense it is particularly important that everything possible should be done to preserve our waters, soil, and forests, and no waste of these resources, such as took place in the last great world war, should be allowed.

DISCUSSION

LORENZ'S OBJECTIVE METHOD OF INTERPRETING BIRD BEHAVIOR

To the Editor of 'The Auk':

Lorenz ('Der Kumpan in der Umwelt des Vogels,' Journ. f. Ornith., 83: pt. 2-3, 1935; 'The Companion in the Bird's World,' Auk, 54: 245-273, 1937) has recently adapted from Uexkull a school of thought for the interpretation of bird behavior. This work has received favorable notice, and promises to have considerable influence on thought in this field. Any new method for attacking the problems of the study of behavior, helping us to understand it, the origin of behavior and the forces controlling its evolution and operation, is more than welcome, and if it proves more satisfactory than the ideas of the old schools, it supplants them. Let us see if the ideas of Lorenz prove more satisfactory.

The basic unit in this school is the 'releaser.' The releaser is that portion of the object which sends out the stimuli to which the bird responds. The bird does not respond to the object as a whole, but to the releaser only, and the bird has such a pre-ordained organization that it responds only to this one combination of stimuli. The rigidity of this relationship is emphasized by comparing it to the relationship between a key and a combination lock. (Lorenz has often been misquoted as saying that the bird reacts to only one stimulus emanating from the object; rather he says to one releaser, which usually furnishes a simple combination of a few stimuli.)

This sets at naught the vast amount of work of experimental psychologists whose work on animals Lashley reviewed in 1938 ('Experimental Analysis of Instinctive Behavior,' Psychological Review, 45: 445-471) and of which he says that, when they first began work, it seemed probable that the exciting stimulus would be found to be simple, but the experiments based on sense privation point to the conclusion that the exciting stimulus in instinctive recognition of mate or young is not mediated exclusively by any one sense modality. Experiments based on varying the properties of the stimulus object point to the conclusion that the instinctive behavior is dependent on a complex of stimuli, and no investigator has found any single property of the stimulus object which cannot be varied within limits without disrupting the pattern. Despite the fact that the probable existence of releasers has not been clearly demonstrated in any cases, the assumption is put forward that all striking color designs and bizarre structural devices in birds find their exclusive use as releasers; and that very complicated structures may function as single releasers.

Are we justified in assuming that any structure whose function we do not know has any function, let alone a very specialized function? One objection which comes at once to mind is the question of mal-adaptions.

It is interesting to examine the factual evidence Lorenz quotes for his releaser concept. The following is the list of the species or groups having releasers mentioned, in 'The Conception of the "Releaser"' section in Lorenz's 'Auk' article (this disregards his data on sea-urchins, spiders, ticks, fish, lizards, cats, dogs, men):

Jackdaw.—Any glistening black dangling object carried by any living creature will cause Jackdaws to attack the living creature. This is the only example given in which the releaser concept seems satisfactory, and here the effects of learning are not considered.

Blue Tit.—(1) Yellow marks on the corners of the mouth of the young release the feeding reaction of the adult. Yet we know that many species of passerine birds will occasionally feed the young of other species (see A. A. Allen, 'The Book of Bird Life,' 1930: Fig. 166, showing Redstart feeding young Robins).

(2) The white circlet of anal feathers releases the nest-sanitation behavior of the adult. Yet, when nest sanitation is first started, the young have no feathers (I am considering this at greater length elsewhere).

Night Herons.—The erectile crest of Night Herons is said to be used to indicate peacefulness. The later work of Noble, Wurm and Schmidt (Auk, 55: 7-40, 1938) found it to be used in courtship and not as Lorenz stated.

Other birds.—In Shell Parakeet, tits, shrikes, doves, "hosts of other birds," Bullfinch, Bean Goose, and "numerous species of the anatide order" the color patterns of these birds, concealed while they are at rest and displayed at the moment of taking flight are said to be "automatic releasers," eliciting a "flying in pursuit reaction" from others of their species. There is no attempt here to evaluate the extent of learning in this connection. There is also a vast literature devoted to other views on the function of 'banner markings.'

Raven.—Two different poses of this species are cited as releasers, but nothing is said as to what they release.

Four species of Anas.—Various 'releasers' are outlined without saying what they release.

Dabchick.—An alleged releaser is cited, without saying what it releases.

Lorenz includes "intention movements" with releasers, saying there cannot be drawn a sharp separating line. Examples of such movements, which transmit excitation by contagion, are given in some geese and ducks. However, when a bird is about to fly and its movements make this evident, Lorenz's definition of Kumpan seems to put the associate bird as Kumpan.

The mention of symbolic releasing ceremonies and their phylogeny is general, except for the following: "Especially interesting is a certain symbolic movement of the Gannet, in which the bird sitting on the nest site 'pretends' to take building material from the bill of an imaginary mate and to build it into a nest which at the time being does not yet exist."

A bird responds differently to some fellow members of its species at different times. Depending on its functional cycle a bird responds differently to its parents, its nest mates, its social associates, its sex partners, and its young. Lorenz calls its associates different Kumpan-names when they represent different objects (call forth different sets of instinctive actions) in different functional cycles. He lists five main Kumpan: parent-, brother-and-sister-, social-, sex-, and child-Kumpan. Apparently in each Kumpan the social functioning parts of the bird constitute a special set of releasers; it acts as a sort of super-releaser. This unity of responses in each cycle depends in part on imprinting.

In classification one might go further and have a parent-warning-sub-Kumpan and a parent-feeding-sub-Kumpan. Indeed it might be possible to go outside the field of the same species and have a water-Kumpan with subdivisions of water-to-be-avoided-sub-Kumpan and a water-to-be-drunk-sub-Kumpan and a water-to-be-bathed-in-sub-Kumpan. However, its usefulness is doubtful. It is well to remember that Watson in 1914 ('Behavior, An Introduction to Comparative Psychology') called this "absurd terminology."

Imprinting.—This is the process by which instinctive recognition of the fellow member of the species is acquired during the life of the bird. Instinctive acts

cannot be influenced by experience. Imprinting is a unique process which has nothing to do with learning. This savors of identification by definition, and a distinction without a difference; it appears to be conditioning, and Lorenz inclines toward this in his later work.

Lorenz frequently speaks of the phylogeny of behavior. According to his views, bird behavior is made up of instinctive acts and intelligent acts. We find: (1) that the instinctive acts are reflexes, unmodifiable by experience; and (2) that individual variations of an instinct can be disregarded; an example is that every healthy wild hen is in every detail a perfect clucking hen. That is, instinctive acts exist. There is no scope for selection, nor is evolution possible here, not if every hen is a perfect hen. This offers no new line of attack on the problem of the origin of behavior. Perhaps Lorenz's views of the higher type of behavior, intelligent or modifiable behavior, offer a better method. But no! According to Lorenz, intelligent behavior is quite distinct from instinctive behavior, and at certain stages simply supplants it. It has no beginning, it just appears.

Lorenz has buttressed his position by saying that he will prove as dogmatic certain prevailing opinions; that some complicated instinct-training interlacements (behavior patterns) will probably never be solved; that linguistic difficulties in interpreting a man's work are great; that if another observer has not noticed something, he is never entitled to make a negative statement; that he uses only the observations of a few other workers with views similar to his own, in whose works he can read between the lines. In many minor aspects of his thesis we can agree or disagree with him; but if the fundamental basis of his thesis is a sort of spontaneous generation of behavior, is it worth while to examine the evidence on which it rests?

In a world where everything is complex, truth seems to vary, and we know not what to believe; it is pleasant to turn to the master and find a rule of thumb by which to proceed. By his logic we can fit together behavior patterns into series, but they have no bearing on the basic problem. That cannot be solved! We do not need to think. It is perhaps pleasant not to think. The need of something absolute and inflexible to which to cling is inherent in the human race. Witness the ideologies which have been set up in the past and are rampant at the present time.

But progress in thought is not made by accepting ideologies blindly. And still we have the hope that by observation, experimenting and thinking, we can gain insight into the origin of life, and the forces which control it. Otherwise biology has no meaning.

A. L. RAND

*American Museum of Natural History
New York, New York*

REPORT OF THE COMMITTEE ON BIRD PROTECTION, 1940

A NUMBER of species of American birds are now threatened with extinction. Although the extensive system of Federal, State, Provincial and private wildlife refuges is doing much to protect and restore many forms of bird life to a more satisfactory abundance, sanctuary and adequate protection have not yet been extended to a few of the more endangered species.

The establishment of ten cooperative wildlife research units in 1935 was sponsored by the State game commissions, the land-grant colleges, the American Wildlife Institute, and the U. S. Fish and Wildlife Service. We are pleased to report that this program, set up for five years, has now been extended for another five years by the sponsors. Cooperative units study the status of various forms of wildlife, seek means to improve conditions for wildlife in the States, and attempt to devise practical management techniques that may be adopted to maintain desirable animal populations. These units are located in Alabama, Iowa, Texas, Virginia, Maine, Utah, Ohio, Oregon, Missouri, and Pennsylvania. Since 1935, more than 35 projects have been completed, and about 375 manuscripts dealing with various management phases have been published.

The former U. S. Biological Survey, now the Fish and Wildlife Service, reports that the wildlife refuges under its charge number 263, covering a total of 13,635,365 acres of land and water. Of these refuges, 176 are primarily for migratory waterfowl with a total of 3,447,218 acres. Fifty areas, with 107,666 acres, are used chiefly by colonial nesting species in such places as bird rocks, mangrove keys, and gull and tern islands. General wildlife refuges for upland game, big game, fur-bearers and birds number 24 and amount to 3,475,903 acres. The thirteen big-game refuges and ranges have a total of 6,604,578 acres.

This Committee wishes that it were possible to give a complete record of the fine conservation work being continued from past years by a number of organizations. Among them are the General Wildlife Federation, the American Wildlife Institute, and the more exclusively ornithological groups such as the National Association of Audubon Societies. The latter's program is especially notable because of its lengthening chain of refuges and the competent research on vanishing species by staff members and holders of research fellowships.

Regarding the various species of endangered birds, we regret to report that the status of the Ivory-billed Woodpecker seems to grow progressively worse, and it is doubtful if the bird can be saved. Its most important, and possibly last, strongholds which are in Louisiana and South Carolina are being lumbered, the latter area preparatory to impoundment of a power reservoir by the Santee-Cooper Authority (see 1939 Committee Report). Extermination is imminent unless acceptable habitat is maintained. It could be delayed and possibly prevented by acquisition and strict protection of the Singer tract in Louisiana.

The California Condor exists only in the United States; therefore its fate depends entirely upon the treatment we give it. Its range and numbers are so limited that they are now leading definitely to extermination. Without question, a more careful study of this bird should have been made many years ago. Whether present belated efforts will prevent the condor from gradually decreasing in numbers and in time suffering the fate of the Passenger Pigeon, Heath Hen, and Great Auk, remains to be seen. Only a small nucleus remains as a basis for restoration. Reproduction is slow and food requirements are of a special nature. Careful study is now being made, however, in the hope of developing effective means of protection and management. To insure the future of the condor, the area set aside in the Los Padres National Forest in southern California is very limited. The birds number about fifty, and the conditions under which they formerly thrived have been greatly changed. Since they are in the habit of ranging over a wide area in order to find food, it is impossible to prevent the shooting of some of the birds by irresponsible gunners. In addition to the small nesting range, which is closed to the public, it is urged that the entire Los Padres National Forest be set aside for the protection of the condor. This area should be closed to all hunting, except the killing by officials of enough deer to furnish food for the birds.

The White-tailed Kite is another bird of California that is seriously limited in numbers. It is suggested that a thorough investigation be made in order to learn definitely whether this bird is increasing or decreasing and to determine what can be done to increase its numbers.

A year ago the famous Everglades of Florida, an exceedingly important wildlife area, were suffering the result of unwise drainage and were stricken with devastating drought and fires. We are pleased to report that because of the encouraging recovery there this year, many forms of bird life have found favorable environmental conditions. The drainage affecting this area, however, has not been corrected.

No appreciable change during the past year seems to have occurred in the numerical status of the Everglade Kite, Roseate Spoonbill, Reddish Egret, Limpkin, Florida Crane or Whooping Crane. Research into their status, needs and management is much needed. Through the extensive Federal refuge program, some sanctuary and encouragement are offered to all of these species. It is encouraging to report that the Great White Heron population continues to increase.

Although the status of the Trumpeter Swan seems to be improving, this majestic bird is by no means safe from extermination. Continued study of its requirements and management is necessary. The species appears to be in a better position than the condor because it is more adaptable, more amenable to management, more extensively distributed, and has a much higher reproductive rate. Three known breeding areas exist. Two of these in the United States (Red Rock Lake Refuge, Montana, and Yellowstone National Park, Wyoming) support a few more than two hundred birds—while a large and inaccessible area in the vicinity of British Columbia has a population of more than five hundred Trumpeters. Although the birds are given reasonable protection, some are undoubtedly killed when they move to adjacent unprotected areas, particularly to those localities occupied also by Snow Geese. It might be taken for granted that the swans would increase in numbers in a reservation like Yellowstone National Park. However, in 1938, only four young birds were successfully reared in this protected park. A pair of Trumpeters have been accustomed to raise a family at Swan Lake in the Park, but this year (1940) that area was abandoned without producing any cygnets.

Much effort is being made to establish Trumpeters in other areas within their ancestral range where suitable nesting conditions and a sufficient winter-food supply exist. In the fall of 1938, six Trumpeters were caught and moved to a lake in the Jackson Hole Elk Refuge in Wyoming. Half of them have survived at present writing, two years later. Three Trumpeters have also been recently transported to the Double-O Ranch, a part of the Malheur Wildlife Refuge in southeastern Oregon, where warm springs maintain open water throughout the coldest winters. While these swans normally have from four to six young each year, their increase is retarded by a number of factors. One of these is lead poisoning, and at Red Rock Lakes, formerly one of the most popular hunting areas in Montana, shot is often available to them in quantity. The swans may at times glean the pellets from the mud and ultimately succumb to lead poisoning. Since the birds now have a restricted range in the United States,

and since an adequate supply of natural winter food is not always available, it is suggested that other transplantings be made to suitable refuge areas whenever birds can safely be spared for this purpose.

Another waterfowl that needs more protection is Ross's Goose. It is the rarest of the geese that regularly visit the United States and is about the size of the larger ducks. As nearly as can be estimated, the total number of Ross's Geese is from five to six thousand. Because they need protection, the Federal migratory-waterfowl regulations forbid their hunting. Unfortunately they tend to flock with the much more numerous Snow Geese on which there is an open season in the West. Although Ross's Goose is distinctly smaller than the Snow Goose, it is of similar coloration and hence is not readily recognized by gunners. Permitted to kill the Snow Geese, they also shoot some of the rare and theoretically protected Ross's Geese. When game wardens examine the bags and find a Ross's Goose, they usually regard this kill as accidental, and therefore merely take possession of the bird, without arresting the hunter. This steady drain upon Ross's Geese is a serious menace to the species because of their small numbers. Apparently the only method of preventing it is to close the season on Snow Geese in the areas where the Ross's Geese winter.

The largest numbers of both Snow and Ross's Geese winter in California. Formerly they ranged to San Joaquin Valley, but due to the destruction of their habitat few are now found there. Most of the birds now winter in the Sacramento Valley and all white geese there should be protected to save the Ross's Goose. If this is not done, this species appears to be doomed.

The American or Bald Eagle, the emblem of the United States, is now protected by Federal law. This protective legislation recently passed Congress and was signed by the President. Its provisions, however, do not apply in Alaska. In 1917, the legislature of Alaska started a campaign against the American Eagle by paying a bounty of fifty cents per bird. During the first six years, up to 1923, bounties were paid for about 18,000 birds. It is safe to say that a larger number were killed as some must have fallen in inaccessible places or died after having been wounded, and doubtless some were killed by persons who did not collect the bounty. From 1917 to the present time the number of eagles killed for bounty in Alaska is believed to be at least 100,000. They are now uncommon over vast areas of the range in the Territory. It is urgently recommended that a study be made of distribution, abundance, population trends, economic status, and need for protection or control of the species in Alaska.

Passing to threatened game species, the facts clearly indicate that

the White-winged Dove of the southwestern border from Texas to California is becoming scarcer each year. Despite its reduction in numbers, this handsome species is intensively hunted and its scarcity appears to be largely due to drought, over-shooting and the destruction of young and nesting birds. It is strongly recommended that a closed season be enforced for at least two or three years.

Among other upland gamebirds, Attwater's Prairie Chicken and the Columbian Sharp-tailed Grouse seem to be in the most precarious condition and in the greatest need of assistance. Their numbers have progressively decreased as a result of impairment of their range by over-grazing and drought, and because of excessive hunting both legal and illegal. It is doubtful whether either subspecies will be saved unless large and effectively managed refuges are promptly established for them. It is greatly to be hoped that Federal, State, and especially Pittman-Robertson funds, can be so allocated that effectively managed refuges for these birds can be set up. We are pleased to report that the status of the Sage Hen shows continued improvement. It now occurs and receives full protection on more than a dozen Federal refuges in the far West and in some of these areas it is becoming fairly abundant.

During January 1940, adverse weather conditions in the Southeast, coupled with legal hunting, made serious inroads into the numbers of Woodcocks and Mourning Doves, with the result that the numerical strength of both species is much below that of 1939. Measures to restrict the kill during the forthcoming hunting season have been imposed.

In view of the continued need for protection of waterfowl, your Committee is opposed to the passage of any bill permitting the baiting of these birds to shooting grounds. It is also opposed to the use of live decoys to facilitate killing. During the past year bills were introduced in Congress (unsuccessfully, we are glad to report) that would have authorized both baiting and the use of live decoys. Legislative action is contrary to the present accepted policy of the regulation of hunting by administrative agencies operating under only organic legislation couched in general terms. This system has the flexibility needed to cope with constantly changing conditions, and is in every way to be preferred to ponderous and usually less informed legislative regulation.

Your Committee is pleased to report that most species of waterfowl have shown an encouraging increase although the supply is still far below the carrying capacity of both the breeding and most of the winter ranges. With the supply of shootable waterfowl as low as it is,

and restoration only half of that expected, your Committee believes the recent change in Federal hunting regulations (especially those lengthening the open season from 45 days to 60 days, and legalizing early-morning shooting beginning at sunrise instead of 7 o'clock, without any compensating reduction in the bag limit or other restriction) is a great mistake. Members of the Union should take every opportunity to familiarize themselves with the waterfowl situation and report the results of this surprising liberalization of the gunning regulations. Support should be rendered law-enforcement agencies, and effort made to bring about an increase in the number of Federal wardens in order that more effective bird protection can be given.

For the future protection of some of our migratory birds that winter in different parts of Central and South America, it is necessary that there be greater cooperation between the United States and other American countries. The Union tenders its sincere appreciation to Dr. T. Gilbert Pearson, President Emeritus, National Association of Audubon Societies, who spent nearly a year in South America studying bird life and working with ornithologists and officials of the different countries with a view to encouraging education regarding birds and their better protection. Dr. Pearson reports: "... very few laws exist in South America for the protection of non-game birds, and in some countries there is not the slightest semblance of a law for the preservation of any land bird."

Although financial aid has been secured for the protection of wildlife in the United States, there is some danger that it will be concentrated on the game species. We believe that more Pittman-Robertson funds should be directed toward the protection and management of rare and vanishing forms of wildlife. Even though 260 projects in 43 States are now in operation, it is appropriate for the membership of the A. O. U. to ask whether this act extending Federal aid to wildlife applies to wildlife as a whole, or only to shootable game. The acid test in this respect will be the degree of liberality shown in allotting Pittman-Robertson funds to the restoration of rare, non-shootable species. In the case of threatened species, there is definite need of habitat protection, for almost all research into life-history requirements is needed as a basis for restoration. The A. O. U. should ask the Fish and Wildlife Service, which administers the Act, for an inventory of its Pittman-Robertson program in behalf of rare species. The Act requires the State conservation departments to initiate projects, hence an over-emphasis on shootable species is highly probable. The best insurance against such over-emphasis will be the constant vigilance of organizations that are interested in conservation of the entire fauna, shootable or non-shootable.

The Committee calls special attention to the following important recommendations:

1. State and Federal aid should be given to the Ivory-billed Woodpecker through acquisition in Louisiana of its last important habitat and possibly the only area in which it now occurs.
2. State and Federal action should protect the unique bird fauna of southern Florida through restoration and conservation of its habitat.
3. The entire Los Padres National Forest should be closed to public hunting and the cougar restored therein as a measure of protection and a means of food-production for the California Condor.
4. The California Game Commission and the Fish and Wildlife Service are urged to close the Sacramento Valley to the shooting of all white geese, in order more effectively to protect the Ross's Goose.
5. After adequate study, the U. S. Fish and Wildlife Service is urged to transplant conservative numbers of Trumpeter Swans to refuges where conditions assure a fair measure of successful propagation.
6. We urge abolishment of the bounty on the Bald Eagle in Alaska.
7. A continuous closed season on the White-winged Dove should be declared by the Arizona Game Commission and the Fish and Wildlife Service.
8. Refuges should be provided for Attwater's Prairie Chicken and for the Columbian Sharp-tailed Grouse by the States of Texas and Utah, respectively, and by the Fish and Wildlife Service.
9. Indiscriminate and irresponsible destruction of predaceous birds should be condemned.
10. Excessive and unnecessary drainage, carried out primarily in the name of mosquito control, should be opposed.

CLARENCE COTTAM

WM. L. FINLEY

ALDO LEOPOLD

VICTOR H. CAHALANE, *Chairman*

NOTE: This report was unanimously approved by the membership of the American Ornithologists' Union at its annual meeting at Cambridge, Massachusetts, September 12, 1940.

FORM OF BEQUEST

In view of the desire on the part of the members and friends of the Union to provide for its needs by bequest to its Endowment, and of the inquiries that are received from time to time as to the proper wording, forms are shown below for the convenience of those who are planning to remember the Union in their wills.

(General)

I give and bequeath to the American Ornithologists' Union, incorporated not for profit under the laws of the District of Columbia.....dollars.

(Specific)

I give and bequeath to the American Ornithologists' Union, incorporated not for profit under the laws of the District of Columbia.....dollars, in trust to be used for the purposes following, that is to say:

(It is strongly recommended that a competent lawyer be employed to prepare the will and to supervise its execution in order that all the requirements of the law of the State in which the maker of the will resides may be fully complied with. It is also wise to give the Union considerable latitude in the use of any fund to be established by bequest, or, of the income therefrom, so that a change of circumstances may not impair the usefulness of the gift. The Treasurer of the Union will be glad upon request to review the phraseology of proposed bequests and to make suggestions with reference thereto.)

THE AMERICAN ORNITHOLOGISTS' UNION AT A GLANCE

ORGANIZED—in New York City, Sept. 26, 1883: Incorporated—in Washington, D. C., Nov. 15, 1888.

OBJECTS: "The advancement of its members in Ornithological Science; the publication of a journal of Ornithology and other works relating to that science; the acquisition of a library; and the care and collection of materials relating to the above objects, under the restrictions and regulations established in its By-Laws."

OFFICERS: President, two Vice-Presidents, Secretary, Treasurer, and 9 Councilors. Officers, the Editor and ex-Presidents are ex-officio members of the Council.

MEMBERS: Associates (unlimited), Members (150), Corresponding Fellows (100), Honorary Fellows (25), Fellows (50), Fellows Emeriti, Patrons. (Total membership in 1940 about 1750.)

DUES: Annual—Associates \$3, Members \$4, Fellows \$5.

Life-Members of any class \$100; Patrons \$1000.

INCOME: From annual dues, sale of publications, life memberships, and contributions.

MEETINGS: Annual—usually in October or November.

PUBLICATIONS: 'The Auk,' a quarterly journal in 57 volumes, with 4 general indexes: 1876–1900, 1901–1910, 1911–1920, 1921–1930. 'Check-list of North American Birds': 1st ed., 1886; 2d ed., 1895; 3d ed., 1910; 4th ed., 1931. 'Code of Nomenclature,' 1886; Revised ed., 1908. (See Auk, '24, 142.)

BREWSTER MEDAL: The income from a fund of \$7250, established in 1919 by the friends of William Brewster, awarded biennially (now annually) to the author of the most important work relating to the birds of the Western Hemisphere published during the preceding six years. Awarded in 1921 to Robert Ridgway, in 1923 to A. C. Bent, in 1925 to Todd and Carriker, in 1927 to John C. Phillips, in 1929 to C. E. Hellmayr, in 1931 to Mrs. Florence M. Bailey, in 1933 to F. M. Chapman, in 1935 to H. L. Stoddard, in 1937 to R. C. Murphy, in 1938 to Thomas S. Roberts, in 1939 to Witmer Stone (posthumously), in 1940 to James L. Peters.

WHERE TO FIND FURTHER INFORMATION

ADDRESSES OF OFFICERS AND MEMBERS—Annual list in April Auk (after 1940 in Oct.).

THE AUK (LOCATION OF SETS)—Auk, '19, 634; '20, 348; '24, 207; '29, 584.

THE AUK IN PUBLIC LIBRARIES—Auk, '30, 609.

BIOGRAPHIES OF DECEASED MEMBERS—Auk, '35, lxviii and current issues.

BREWSTER MEDAL—Auk, '20, 29; '22, 86; '24, 125; '25, 484; '26, 69; '28, 71; '30, 219; '32, 52; '34, 53; '36, 57; '38, 317; '39, 113; '40, 142.

BY-LAWS: Auk, '27, xi; Auk, '38, 330–340.

DATES OF PUBLICATION OF THE AUK (1912–1940) follow the Index in each volume or the title pages in later volumes.

HISTORY OF THE UNION: Allen, J. A., 'A Seven Years' Retrospect,' 1891; 'The A. O. U.,' Bird-lore, 1899, 143.

Palmer, T. S., 'The A. O. U.,' Am. Mus. Journal, '18, 473; 'Looking Backward,' Auk, '24, 139; Fifty years' progress of American Ornithology, 1933, 7–27.

MEETINGS: Auk, '24, 143; '30, back cover of October number.

MEMBERSHIP:—Auk, '24, 140; Fellows, '18, 110; Foreign Members, '18, 266; Members, '18, 384; Associates, '18, 513.

PERMANENT FUNDS: Auk, '20, 513.

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DR. GLOVER M. ALLEN

*Museum of Comparative Zoology
Cambridge, Mass.*

Information relative to advertising, subscriptions, requests for back numbers of 'The Auk,' as well as for other publications of the Union, changes of address and remittances should be sent to the Treasurer and Business Manager,

RUDYERD BOULTON

*Field Museum of Natural History
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